OCTOBER 1952

PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
PERMANENT MOLD CASTINGS
PLASTER MOLD CASTINGS

PMM

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Cooking surfaces have greater sales appeal when finished with Velvaglaze. The hard, dense Velvaglaze finish resists staining from continued cooking action and frequent cleaning.

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• Complete Product Assembly
• Every Modern Finishing Service
Detroit Ave. at W. 93rd St., Cleveland 2, Ohio

CASTING NEWS NOTES

FLUCTUATIONS EXPERIENCED in metal costs during the past few years have greatly influenced the use of non-ferrous castings. Metal costs are a major factor in the price of any non-ferrous casting. It is extremely important at all times to analyze closely the metal alloy and the price of the metal on any quotation, in order to obtain a factual competitive analysis.

* * *

THIS IS ONLY ONE of many factors which cost-conscious manufacturers analyze today when reviewing competitive quotations on their casting requirements. A most important factor is the end cost of the casting after machining, finishing and assembly when all of the variables have been carefully considered.

* * *

THERE ARE MANY honest differences of opinion that can arise in the interpretation of a blue print between a design engineer and the ultimate fabricator. Most of these situations can be properly clarified in advance by means of marked blue prints and "spelled out" conditions properly submitted with a price estimate.

* * *

WHEN THESE FACTORS have been thoroughly analyzed in conjunction with any additional fabrication planned by the manufacturer, it is then possible to arrive at a factual end cost. Many successful casting buyers have learned through experience to beware of the bidder who quotes without any questions or any explanation of the quality standards he intends to maintain.

* * *

THERE IS A NOTICEABLE tendency today on the part of manufacturers to request quotations on completely finished parts and assemblies. This method of buying very often eliminates excess overheads in machining, finishing and assembly time and cuts out intermediate inspection costs and losses. Castings purchased in this manner are received, ready for assembly, subject to one final inspection with the full responsibility assumed by the casting vendor. Monarch has developed many facilities that lend themselves to this type of production. We welcome the opportunity to quote on this type of inquiry to the extent that the operations involved fit into our expanding capacities.

* * *

Monarch Aluminum has constantly expanded the production of "end products". Monarch personnel is trained in product quality methods. We invite you to determine for yourself the extent that the Monarch "production package" will help you reduce your manufacturing costs. MONARCH ALUMINUM MFG. COMPANY, DETROIT AVENUE AT WEST 93rd STREET, CLEVELAND 2, OHIO.

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ALLOY PRECISION Castings Company

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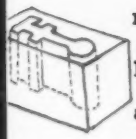
Important pass this on

To Executives Charged with Responsibilities
of Design, Development and Production:

This is intended to call your attention to the Mercast frozen mercury process of investment casting — a development that manufacturers find helpful in solving difficult design and production problems. We suggest that you immediately investigate this versatile process which makes available one-piece shapes previously impossible to cast or machine.

Get this!

Frozen mercury patterns and our special ceramic investment material permit surface finishes and dimensional tolerances never before available in foundry production. For example, ±.002 to .003" per inch is consistently held. In many applications, our castings require no finish machining. Some mercastings, with intricate shapes and cavities, were previously fabricated parts which required expensive machining and assembly, or were too costly to make at all.



Big savings here... up to 78%?

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Our metallurgists can help you get mass production in such hard-to-machine metals as pure nickel, Hastalloy B, Rexalloy 108, stainless, Stellite, and others, both ferrous and nonferrous, at exceptionally close tolerances. Current applications — radar, aircraft, automotive, electrical, and machinery — indicate the wide, economical adaptability of mercasting. Here may be the answer to your problems involving design ... materials ... costs ... weight ... time ... machining capacity.

this hits home

If this discussion suggests use of mercastings by your company, write to Dept. A-6 for Bulletin 706 — or tell us your specific problems. Our metallurgists and Mercast engineers will be glad to serve you.

Drop a note today!
Send those tough problems...

Sincerely,
Alloy Precision Castings Company

Alloy Precision Castings Company

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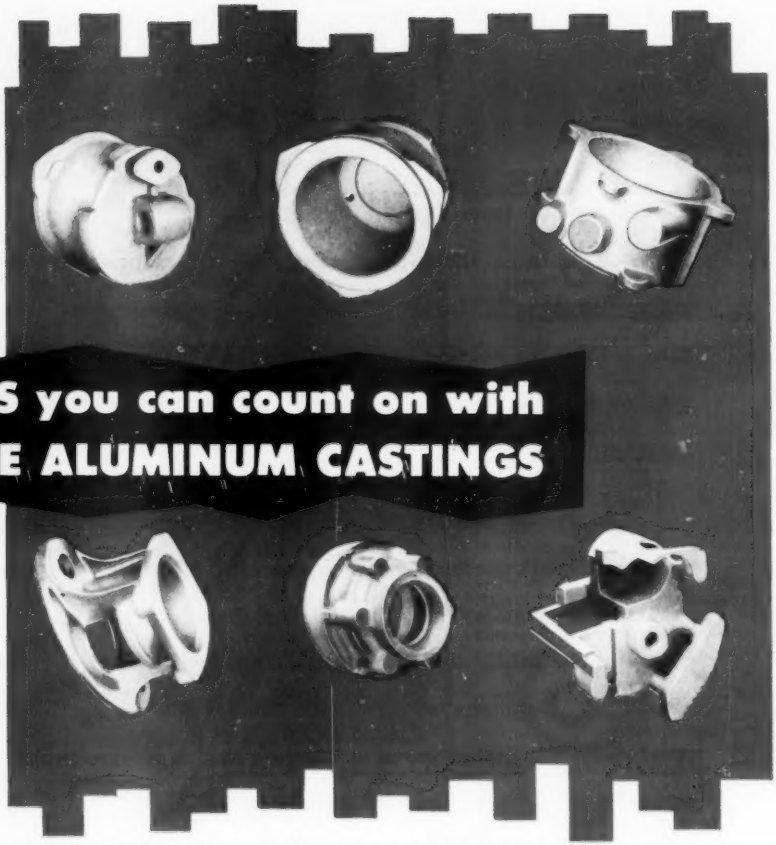

VALUES you can count on with PERMITE ALUMINUM CASTINGS

FREE to Executives!
Write for 80-page manual on the design, production and uses of aluminum castings.

If a dependable service on aluminum castings of top quality will help smooth out your production, take a moment to check over these values offered you in Permite Aluminum Alloy Castings — Permanent Mold, Semi-Permanent Mold and Sand.

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OCTOBER 1952
Vol. 10 No. 10

PRECISION METAL MOLDING

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PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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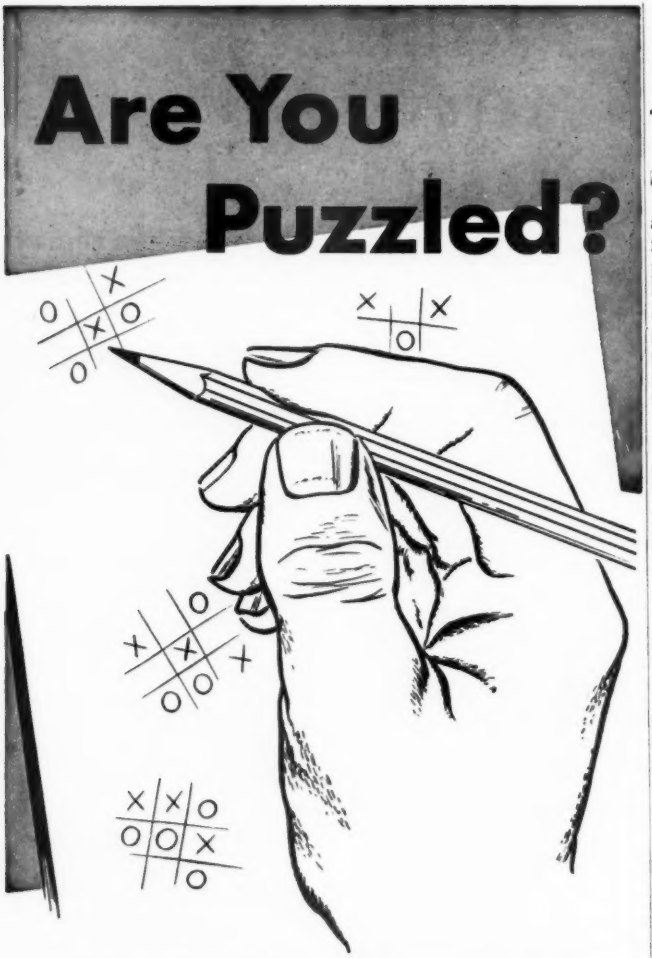

Yes, die castings are different. It takes more than machines to produce die castings.

Die Castings are Newton-New Haven's business. Here is an organization that has production and engineering talent to help you with your die casting problems.

Newton-New Haven has prepared a booklet on "Dimensioning Die Castings." This is basic data that every Engineer and Designer should have. Write on your company letterhead for your copy.

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LETTERS TO THE EDITOR

ALUMINUM DRAWER KNOBS

We have been trying to locate a manufacturer with equipment for pressure casting aluminum, particularly one who might have the dies for a drawer knob. It has been suggested that your publication might give us a list of manufacturers and a possible lead on anyone making this type of piece. — P. L. S.

We do not have any complete list of such sources, inasmuch as it is not standard practice for die casters to produce from stock dies. We have sent a few names of die casters who we know have a few stock dies of have such dies available are invarious sorts. PMM readers who vited to let us know. — Ed.

SHELL CASTING INFORMATION

I would like to have information on "Shell castings". Can you tell me where I can get this information and is there anyone in New England doing this type of casting, particularly in brass or bronze? Can cores be used with shell castings? — R. L. T.

The shell molding process, also known as the Croning process, is coming into use, but at present, very few foundries are actually in a position to do production casting by this method. Names of several have been forwarded. Also, names of suppliers of materials and equipment for shell molding have been forwarded, since each of these companies has prepared and published descriptive literature on various phases of the process. Some of these have put out handsomely illustrated and diagrammed booklets.

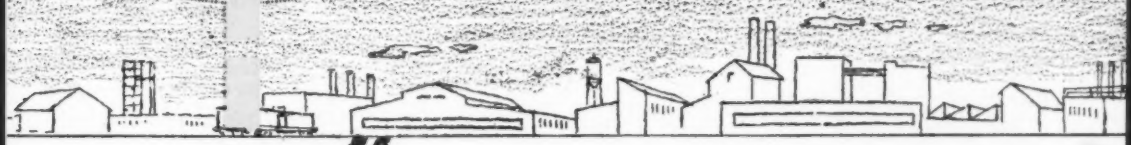
In addition, we wish to point out that in the November issue of PMM, a feature article describing this process and pointing out some of the pro's and con's will be offered. It has been written for PMM by two metallurgists from Watertown Arsenal. — Ed.

continued on page 6

THE RIGHT WAY *to quality zinc die castings*

CERTIFIED ZINC ALLOY PLAN
LICENSED PRODUCER
AMERICAN DIE CASTING INSTITUTE

. . . and the way to be certain of "on grade" alloys . . . the CERTIFIED ZINC ALLOY PLAN



You're on sure ground when your die castings are made by a CZ Licensed Producer. No matter what your requirements, the **CZ Alloy Plan**, through constant periodic inspection and testing, guarantees their fulfillment with the proper alloy.

Any of the leading die casting firms listed here, the only licensed **CZ Alloy Plan** producers, will be glad to explain the plan to you or discuss any die casting problem you may have. A free folder, outlining in full the operation of the **CZ Alloy Plan**, will be sent upon request.

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A & A Die Casting Co., West Los Angeles, Calif.
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Du-Wel Metal Products, Inc., Bangor, Mich.
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Globe Imperial Corporation, Rockford, Ill.
C. M. Grey Mfg. Co., East Orange, N. J.
Heick Die Casting Corp., Chicago, Ill.
Hiffinger Corporation, Toledo, Ohio
The Hoover Company, North Canton, Ohio
Kamin Die Casting & Mfg. Co., Chicago, Ill.
Kiowa Corporation, Marshalltown, Iowa
Paul Ksone Die Casting Co., Chicago, Ill.
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Milwaukee Die Casting Company, Milwaukee, Wis.
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Mt. Vernon Die Casting Corp., Mt. Vernon, N. Y.
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Yes—you'll get ***Action*** with ***Accuracy,*** from ***Start*** to ***Finish*** at ***FORT***—and insure the proper and most economical production for your die cast products. We invite your inquiries.

TRADE FORT MARK

FORT DIE CASTING CORP.

MARYSVILLE, MICHIGAN

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LETTERS TO THE EDITOR
continued from page 4

YELLOW BRASS CAST IN PLASTER

Please send us the names of several foundries who cast yellow brass in plaster moulds. — E. H .P.

We have received many requests for this type of facility. Information forwarded. — Ed.

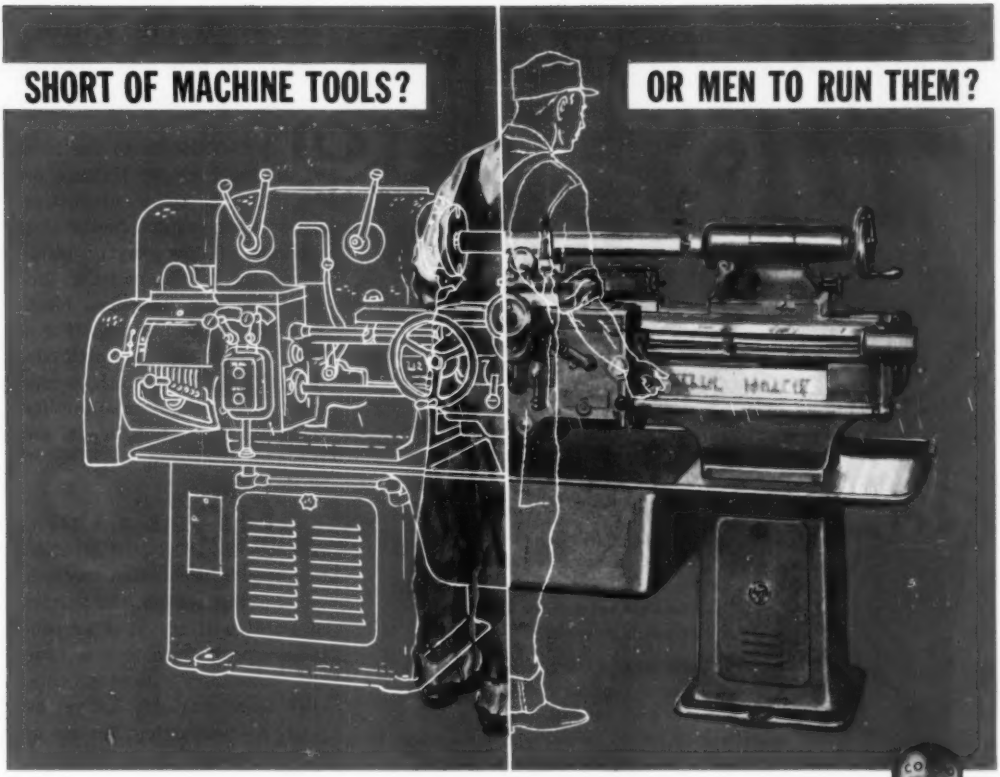
SOURCE OFFERED FOR ANTI-GALLING COMPOUND

The September 1952 issue of your magazine under the heading "Letters to the Editor" contains an item about an anti-galling compound known as "Ragosine". This product is produced by the Ragosine Oil Company, Limited, Ibex House, Minories, London E. C. 3, England. This product is of a grease consistency and contains molybdenum disulfide. We understand the product is packaged in squeeze tubes and also in cans. We do not know whether the product is available in this country.

The use of molybdenum disulfide as an anti-seizing and anti-galling material has received considerable attention. As a result, it is now being used in a wide variety of applications. There are a number of companies here in the States that are marketing molybdenum disulfide lubricants either as a dry powder or combined with various types of carriers. We are attaching a list of companies that we understand are producing and selling molybdenum disulfide. We are producing and selling Moly-Sulfide of a grade suitable for lubricating purposes. We are not selling this product in quantities less than 50 pounds.

We would appreciate it if you would pass this information along to the party that made the inquiry through your magazine. — T. D. Parker, Metallurgical Engineer, Climax Molybdenum Co.

The list has been forwarded to the inquirer. — Ed.



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Parts die-formed by *powder metallurgy* methods from "COMPO" porous bronze and "POWDIRON" sintered iron are *ready for installation* when they reach you. They're accurately die-formed at Bound Brook to the final dimensions you want. There's no need for machining operations at your plant! When you specify "COMPO" and "POWDIRON" parts in your product designs, you free critical tools and skilled manpower for other tasks. And you can speed up production, because "COMPO" and "POWDIRON" are in freer supply than some other materials.

Write on company letterhead for information on "COMPO" and "POWDIRON".

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COLD FACTS

about YORK'S new ICE CUTTER

YORK FLAK-ICE AUTOMATIC ICE MAKER, MODEL DER-2

ICE HARVESTING SYSTEM

ATLANTIC'S ICE CUTTER CASTING

AN IMPORTANT COMPONENT of York Corporation's most recent development, the York-FlakIce Automatic Ice Maker, is Atlantic's ice cutter casting. It cuts the ice into curved flakes... so delicate they will not damage or puncture delicate rose petals.

YORK'S ORIGINAL CONCEPTION of the ice cutter... a vital part of the ice harvesting system ...consisted of three stainless steel parts which had not only to be machined, but welded together.

ATLANTIC'S ENGINEERS suggested a design that eliminated these costly operations and increased the productive efficiency of the ice cutter. Six spiral blades on a center shaft were all plaster mold cast in one piece of Atlantalloy #31 High Tensile Manganese Bronze... an alloy of great endurance and strength.

York will testify that Atlantic's all-in-one-piece ice cutter casting surpassed all requirements for high physical values, closely-held tolerances, satin-smooth finish, fine-grained structure, clean-cut surfaces... and afforded them substantial savings over former costs.

Find out how the Atlantalloy plaster mold casting process can help solve some of your problems. Write for a free copy of "High Quality Precision Castings for Industry" today!

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Established 1937
721 Bloomfield Avenue • Clifton, N. J. • PRescott 9-2450

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Between The Lines

in this and coming issues of PMM

• NEWCOMER to the field of applying bright finishes on die castings on a production basis is the vacuum metallizing technique, now being introduced for bright, metallic surfaces on toys, novelties, hardware, trim and housings. For a full report on the methods, quality of surface finish, equipment required and its suitability for your production needs, see the article starting on page 70 of this issue.

• TODAY'S LABORATORY TECHNIQUE is often tomorrow's production method, and for this reason, the editors of PMM will try to offer progress reports from time to time on laboratory developments, even those that may not yet be ready for production. For one of the interesting developments at Stevens Institute of Technology with sponsorship of the Bureau of Ships, see the article on hot forging of metal powders beginning on page 38.

• THE WORD PRECISION is often used to identify the process more accurately called the "investment casting" technique. One of the most misunderstood features of ths ancient and yet modern casting method is the degree of precision which can be expected. To help clarify this for design engineers, PMM presents a review of precision as it applies to investment castings, starting on page 36.

• EMPHASIS ON PURITY of alloys used in producing zinc die castings has been stressed over and over. The American Die Casting Institute's Certified

continued on page 10

Precision casting news

The cam drum illustrated is typical of Arwood designing for economy. The machining and tricky assembly of thirteen component parts previously used in its manufacture has now been eliminated.

by Arwood Engineers

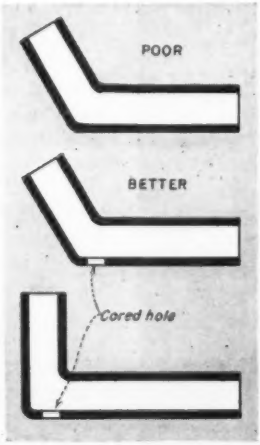
Arwood engineers work in many industries analyzing and solving problems. If you have a particular design or production problem, why not discuss it with us? Our engineering staff is at your service without any obligation whatever.

H. B. BROWN

Henry B. Brown—the Arwood "Star Man" serving New England—has applied Arwood efficiency principles to his own job. By installing a mobile telephone in his car he is able to maintain contact with his customers at all times. Faced with time difficulties, he bought an airplane, learned to fly it, and now uses it both on customer calls and delivery of parts when time is short.

TIP TO DESIGN ENGINEERS

Cored holes shown serve to support the internal core and make possible uniform walls throughout.



For more complete information write for our booklet, "Alloy Selection and Design for Investment Castings", and visit our booth, No. 1758, at the National Metal Exposition in October in Philadelphia.

ARWOOD

PRECISION CASTING CORP.

72 WASHINGTON STREET • BROOKLYN 1, N. Y.

Plants: Brooklyn, N.Y., Groton, Conn., Tilton, N.H.

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• the Quality Machines

for the Production of

DIES LIKE THESE

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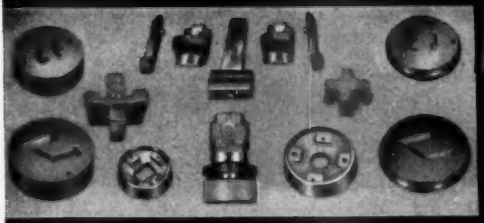

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BETWEEN THE LINES
continued from page 8

Zinc Alloy plan and the almost universally accepted standards of the American Society for Testing Materials, have indicated the close control needed on minor elements. Methods of inspecting zinc alloys for chemical content are outlined in an article beginning on page 47.

• CHROMATE FINISHES for protecting die cast aluminum are extensively reported in an article, Part One of which appears in this issue beginning on page 61. Tabulation of many tests of performance make this particularly valuable.

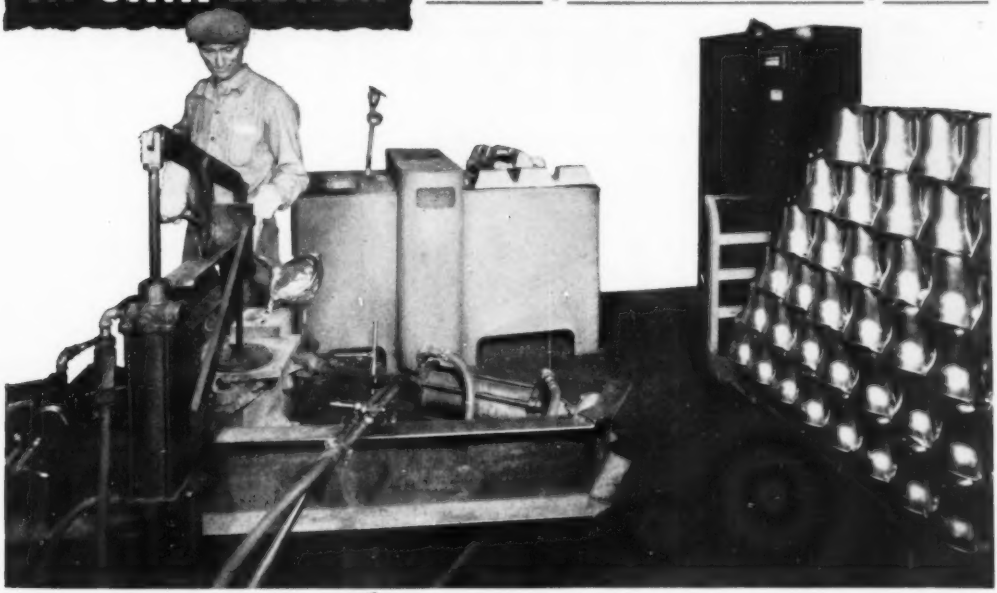
• WHERE PLASTER MOLD castings fit into the production picture can be determined by the survey of the process, now concluding with a discussion of castable alloys, beginning on page 40.

• IN NOVEMBER, watch for some outstanding articles, including the first of a two-part review of the use of investment castings for aircraft structural parts by Republic Aircraft. A detailed step-by-step outline, from conception to inspected casting will be included.

• CLEAR PROTECTIVE COATINGS used on a chromium plate system will be the subject of a comprehensive article prepared for PMM.

• AN INTRODUCTION to the much-discussed shell molding process will be offered written for PMM by two specialists at Watertown Arsenal.

IN-SINK-ERATOR *increases production 50%... cuts rejects 33%*



WITH *LINDBERG-Fisher* 2-CHAMBER MELTING FURNACE

In-Sink-Erator Mfg. Co., Racine, Wisconsin, manufacturers of the nationally known In-Sink-Erator Food Waste Disposer, are increasing production, and improving product quality with a Lindberg-Fisher 2-chamber Induction Melting Furnace. The furnace, a 50 KW unit, is used to melt aluminum prior to casting into container housings for the In-Sink-Erator.

Here's what E. E. Wieczorek, works manager, has to say about his Lindberg-Fisher:

"This new melting furnace is really doing a job for us. With it, we've been able to increase production 50% and cut mold maintenance in half. And our rejects are down to less than 3% . . . a 33⅓ reduction from rejects with the old crucible melting furnaces. Speaking of crucible furnaces brings up another point . . . since replacing our crucible furnaces with the Lindberg-Fisher Induction Furnace our labor turnover in the Molding Dept. has been stopped flat."

Check these
***LINDBERG-Fisher* advantages!**

- **CLEANER MOLTEN METAL** . . . Residue and impurities remain in charging chamber . . . only clean, residue-free metal passes to ladling chamber.
- **CONTINUOUS LADLING** . . . 2-chamber design allows cold metal to be added to charging chamber without affecting temperature of ladling chamber within operating limits of furnace.
- **COOLER OPERATION** . . . Induction heating heats only the metal, not the entire furnace. No flame . . . no products of combustion. Only comparatively small area of molten aluminum is exposed to operator.
- **LESS MAINTENANCE** . . . Refractory-lined chambers . . . no crucibles or pots to replace. No burners to replace or adjust.

For detailed information ask for Bulletin 560, "Lindberg-Fisher Two-Chamber Induction Melting Furnaces"

LINDBERG-Fisher MELTING FURNACES

Lindberg Engineering Company, 2463 W. Hubbard Street, Chicago, Illinois.

For additional information Circle No. 19 on the Reader Service Card

The familiar symbol of Silverstein & Pinsof

GROWS INTO THE NAME

SiPi METALS CORP. *formerly Silverstein & Pinsof, Inc.* **1720 ELSTON AVE. CHICAGO 22, ILLINOIS**

BRASS • BRONZE • ALUMINUM • LEAD • TIN • SOLDER • SHOT ALLOYS • BABBITT • ZINC BASE ALLOYS • NICKEL ALLOYS

Smelters and Refiners for Over 40 Years Sales Offices in Pittsburgh and Milwaukee

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For additional information Circle No. 30 on the Reader Service Card

A FEW OF THE THOUSANDS OF SMALL DIE CASTING PARTS WHICH HAVE BEEN MADE MORE ECONOMICALLY THAN ON ANY OTHER EQUIPMENT.

"HARDWARE FINISH" on your TOUGHEST CASTINGS

DCMT SALES CORP.

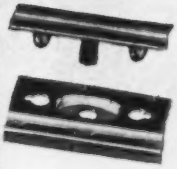
DCMT DIE CASTING MACHINES

800 SHOTS per hour from inexpensive Pre-fabricated dies

SHOWER TEMPERATURE CONTROL

CAR WINDOW REGULATOR HANDLE

LIGHTER

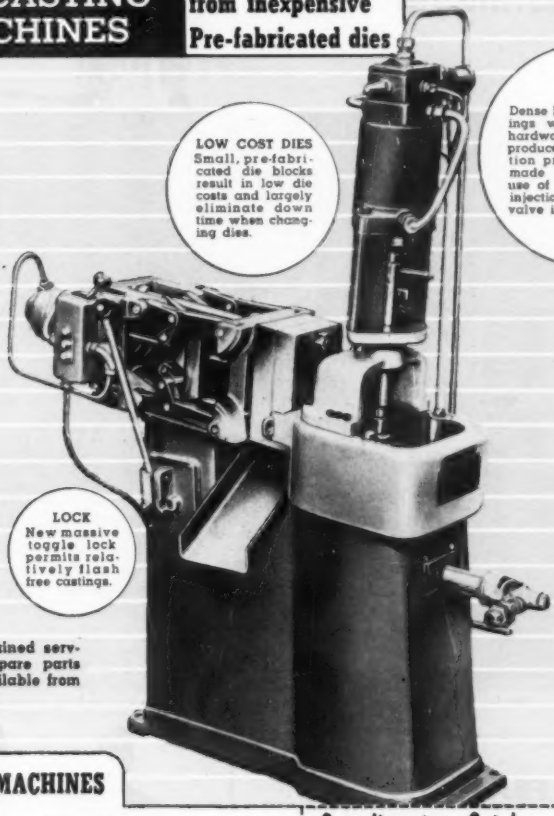


RAZOR

TOY PISTOL

LOW COST DIES Small, pre-fabricated die blocks result in low die costs and largely eliminate down time when changing dies.

FINISH Dense homogeneous castings with high quality hardware type finish are produced by higher injection pressures. This is made possible through use of new impact type injection and patented valve in head.



LOCK New massive toggle lock permits relatively flash free castings.

Factory trained service and spare parts stocks available from New York.

SERVICE Our field engineers are available to offer complete engineering and die design service. Furthermore, we will design your first die free of charge if you so desire.

DCMT DIE CASTING MACHINES

Low cost, high efficiency, small die casting machines, which have won the acclaim of engineers throughout the world. DCMT machines produce precision die castings at high speeds with remarkably low operating costs! Dies are small, inexpensive, readily interchangeable. Non-productive time reduced to a minimum!

Model	IMP 86	ADC56	MSSA/HF
Size of Die Plates	8 x 9	6 x 5	6 x 5
Size of Die Plates Max.	9 x 9	8 x 6	8 x 5
Toggle Die Locking Pressure	12 tons	6 tons	6 tons
Capacity in Ounces	16	2½	12
Std. Dia. of Plunger	1½"	1"	1.200"
Floor Space	30" x 12"	35" x 12"	30" x 12"
Net Weight—Lbs.	450	250	400

DELIVERY 30 DAYS OR LESS

Complimentary Catalog

DCMT SALES CORP. DEPT. PM-10
164 Duane St., New York 13, N.Y.

- ☐ Complete details, current prices and all pertinent specifications are included in the new DCMT catalog.
- ☐ Please arrange for me to see a DCMT Die Casting Machine in operation in my locality.
- ☐ I am enclosing sample or drawing for free cost analysis as produced on DCMT machines.

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Company.....

Postion.....

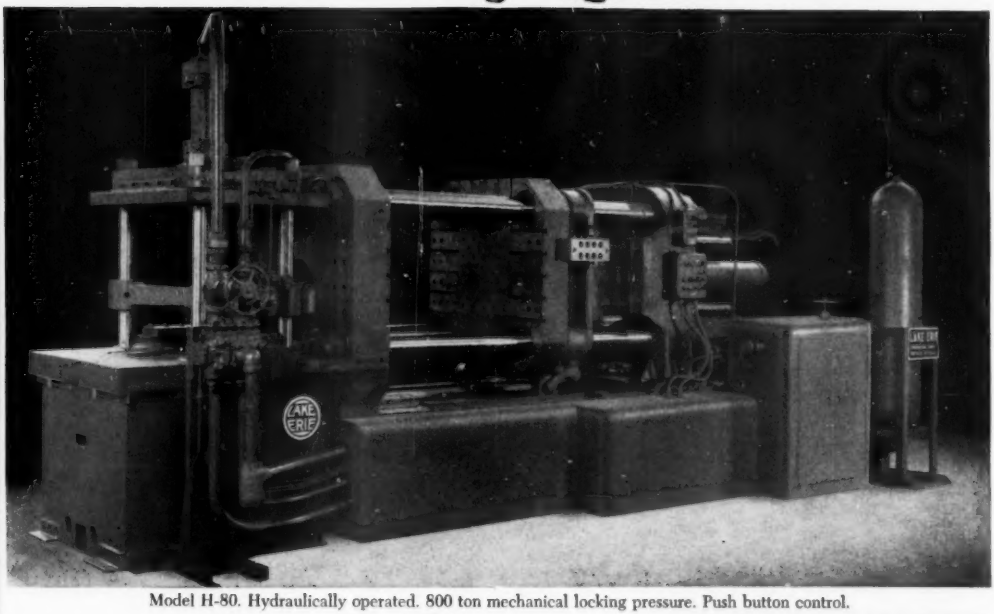
Street.....

City.....State.....

DCMT SALES CORP. 164 DUANE STREET NEW YORK 13, N. Y.

Have you investigated the new Lake Erie Die Casting Machines?

THESE REVOLUTIONARY MACHINES ARE INCREASING PRODUCTION AS MUCH AS **15% to 25%** FOR LEADING DIE CASTERS



Model H-80. Hydraulically operated. 800 ton mechanical locking pressure. Push button control.

FEATURING

- PATENTED "WEDGE CAM" TOGGLE
- PATENTED "PRESSURE-PAC" INJECTION UNIT

Choice of 10 Models from 100 to 1000 tons for zinc, lead, tin, aluminum magnesium and brass. Write for complete details and Bulletin 23.1.

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ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

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MANUFACTURERS OF
HYDRAULIC PRESSES & SPECIAL MACHINERY

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Manufactured in Canada by Canada Iron Foundries Ltd.
LAKE ERIE ®

LAKE ERIE HYDRAULIC PRESSES are available in any size... standard, modified and special designs—horizontal and vertical types—for Metal Working—Plastics Molding—Forging—Metal Extrusion—Processing—Vulcanizing—Laminating—Stereotype Molding—Die Casting—Briquetting—Baling—Special Purpose.

For additional information Circle No. 18 on the Reader Service Card

Precision Castings Co., Inc. acquires Bradley-Edlund Corporation

●

On August 25, the Precision Castings Company, Inc., acquired the Bradley-Edlund Corporation of Cortland, N. Y. We believe this acquisition will mean direct benefits not only to the companies involved, but to their customers as well.

Additional manufacturing facilities mean increased production of Precision dies, tools, fixtures, and general and special purpose machinery—production which will alleviate the present and future needs of Precision's customers.

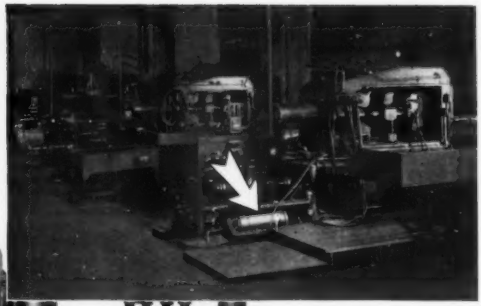
Bradley-Edlund, manufacturers of forging hammers, standard and special purpose drilling and tapping machines, and other types of special purpose machinery, will continue to serve customers now being supplied by them. To the more than thirty years experience of Bradley-Edlund will be added Precision's engineering knowledge and long experience in handling and applying drilling and tapping equipment to many complex die castings. This should prove highly beneficial to the acquired company and its customers.

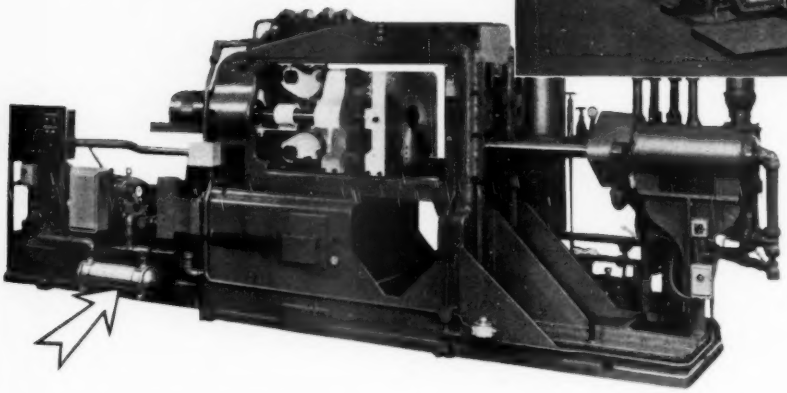
Everyone benefits from progress as is reflected by the growth of our own nation. Thirty years of Precision's history reflect a similar progress aimed toward a constant betterment of products and service.

PRECISION CASTINGS CO., Inc.
212 Walnut St., Fayetteville, N. Y.
Syracuse, N. Y. · Cleveland, O. · Chicago, Ill.
Kalamazoo, Mich. · Cortland, N. Y.
British Affiliation — Wolverhampton Die Casting Co., Wolverhampton, England

For additional information Circle No. 28 on the Reader Service Card

hydraulic oil always at prescribed temperature





LESTER-PHOENIX DIE CASTING MACHINES ARE COMPLETE WITH ROSS EXCHANGERS

Precision construction and high speed operation — these are two of the characteristics that enable Lester-Phoenix die casting machines to maintain peak production of quality die castings day in, day out, year after year.

To safeguard such efficient performance, Lester-Phoenix must be assured of two points particularly in selecting accessories:

(1) Structural qualities must match its own.
(2) Engineering design must more than meet the high speed demands of the machine.

And so it is that Ross Type BCF Exchangers have been used for so many years.

Unless adequate provision is made, continuous operation at high speeds, plus the heat of holding-down pressure, run up the temperature of hydraulic fluid. When that happens, oil becomes thin, causes pump slippage and the hydraulic unit fails to deliver required power. Obviously, Lester-Phoenix engineers could not tolerate that. And they don't! Ross Exchangers are there to guard against it. They don't permit the oil to overheat, keeping it always at the prescribed temperature level.

Says Lester-Phoenix: "Ross oil coolers play an important part in the successful operation of our die casting and injection molding machines, requiring a minimum of maintenance and service."

If you would like to have that kind of confidence in the oil cooling efficiency of your machines, if you would like your customers to share your confidence, find out more about the Ross "BCF". Request *Bulletin 1.1K5* for full details on this compact, all-copper and copper alloy exchanger which is pre-engineered, fully standardized and mass produced.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1446 West Avenue Buffalo 13, N. Y.
In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

Serving home and industry
AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

For additional information Circle No. 17 on the Reader Service Card

aircraft component steel parts made from ACCUMET PRECISION INVESTMENT CASTINGS

The pictured castings are currently being used to produce such important aircraft accessories as fuel injectors and regulators, carburetors, landing gear door latch mechanisms, rocket release mechanisms and radar equipment. Cast to close tolerances with smooth surface finish, expensive machining operations are avoided—resulting in saving of valuable time, reduction in cost and eliminating the need for hard-to-get machine tools. Also *Accumet Precision Investment Castings* permit the use of higher alloyed steels that are difficult or impossible to machine or forge, thus increasing the life or performance of the component parts.

ENGINEERING SERVICE AVAILABLE

Crucible engineers and metallurgists are available to assist you in solving your design or production problems by the application of these Accumet Precision Investment Castings . . . that are playing such an important part in our National Defense Program.

CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

ACCUMET PRECISION CASTINGS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

For additional information Circle No. 9 on the Reader Service Card

number 1 of a series

DIE CASTING is the Process...

2 ZINC, the Metal...

3 BUNKER HILL, the Preferred Zinc

DIE CASTING is the fastest of the metal casting processes. As a high production method, die casting ranks with stamping, powder metallurgy and screw machine production where large quantities of identical non-ferrous metal parts are required.

Aptly named "the shortest distance between raw material and finished product" die casting has proved itself as a high-speed, accurate, low-cost production tool. The extent to which industry adopted this high-efficiency process is evidenced by the rapid and phenomenal growth of die casting and its concurrent – and still growing – importance as a consumer of non-ferrous metals. In 1926, for example, only 13,000 tons of zinc were used for the manufacture of die castings. In recent years, the industry's annual consumption of Special High Grade Zinc has averaged nearly 300,000 tons – making the die casting industry the largest single user of "four-nines" zinc in the United States.

Eastern Sales Agents: **ST. JOSEPH LEAD CO., 250 PARK AVE., NEW YORK 17**

BUNKER HILL 99.99+% ZINC

Sales Office for Pacific Coast: **NORTHWEST LEAD CO., SEATTLE, WASH.**

You're always right with AUTO-LITE Die Castings

● Many of America's leading manufacturers, producing a wide variety of products, are benefiting from Auto-Lite die cast research, experience and advancement. Such developments as high pressure casting, special alloying practices and improved quality through the "controlled metals process" make Auto-Lite the logical source of supply for precision die castings. Address inquiries to:

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Lockland Division, Cincinnati 15, Ohio

600 So. Michigan Ave.
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Detroit 2, Michigan

Tune in "Suspense!"
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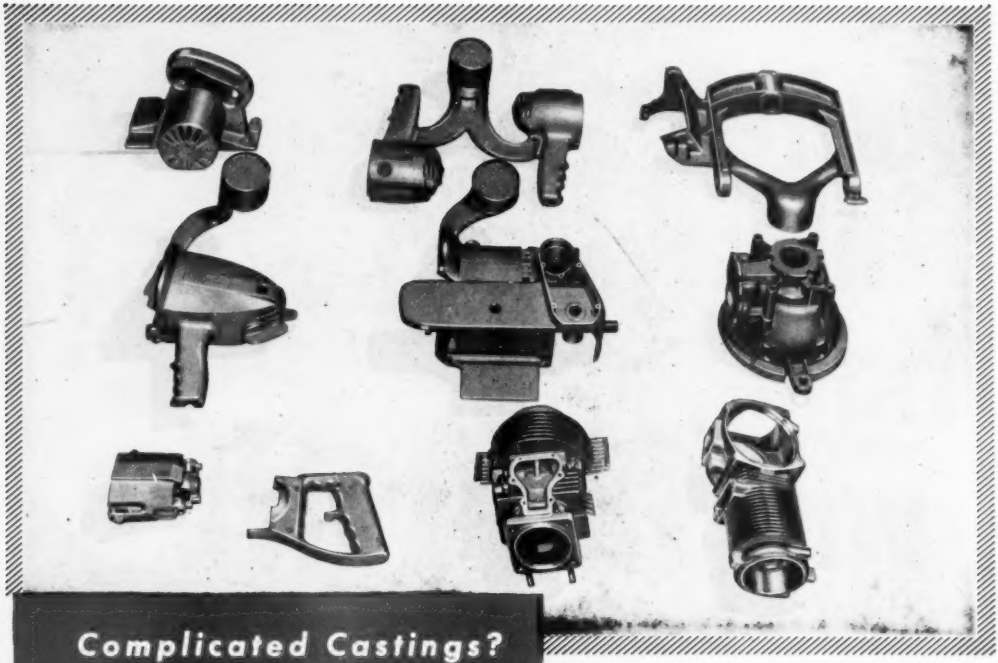
DIE CASTINGS • WIRE & CABLE • PLASTICS • INDUSTRIAL THERMOMETERS

For additional information Circle No. 13 on the Reader Service Card



Complicated Castings?

H-P-M "400" Die Casters Produce them for *Mall* Tools!

Mall Tool Company reports—"Our three H-P-M Die Casters work 17 hours a day, 5½ days a week and are giving excellent service".

Mall's famous line of portable tools calls for a wide range of die castings . . . many of them complicated castings of intricate design . . . all produced on H-P-M's.

H-P-M's new Model 400-B high speed die casting machine, with built-in nitrogen accumulator, offers injection speeds up to 400 ft. per minute and produces aluminum castings weighing up to 12.2 lbs. Other design features include all-hydraulic die clamp for fast, simple die change-over . . . hydraulic ejectors . . . dual hydro-electric safety devices . . . maximum injection pressure when die is filled . . . and independent handwheel adjustment for both die clamp and injection pressures.

Discuss your die casting problems with an H-P-M engineer and profit from 75 years of specialized experience in the field of hydraulics.

SPECIFICATIONS MODEL 400-B

Size of Die Plates	Space Between Bars	Die Opens	Maximum Die Space	Capacity Per Shot (Lbs.)	Net Wt. (Lbs.)
38"x38"	23"x23"	16"	42"	2.2 to 12.2 (Al)*	40,000

*NOTE: The model 400-B handles brass and magnesium die casting as well. Complete specifications on request.

Write for Catalog 5106, today!

THE HYDRAULIC PRESS MFG. COMPANY
1094 MARION ROAD MOUNT GILEAD, OHIO

75th YEAR HPM

For additional information Circle No. 15 on the Reader Service Card

creative castings

Motor End Frames

Gyrol Fluid Coupling

Garbage Disposer Housing

Aircraft Piston

Torque Converter

Fuel Pump Body

Carbon Pile Regulator

Steel-Belted Piston

Alternator Housing

Diesel Permanent Mold Piston

Wing Actuator

Air Connector

Launching Barrel for Bazooka

For many years the foundry of Thompson's Light Metals Division quietly cast thousands and thousands of hard-to-make precision parts in light alloys of aluminum and magnesium for customers in the automotive and aircraft fields.

Then word got around in other industries that Thompson had the experience and facilities to cast light-weight, strong, heat-resisting alloy parts in permanent molds and high pressure dies—which eliminated the weight problems of ferrous counterparts. One by one manufacturers of widely different products came to Thompson for help and advice when they learned that the close tolerances achieved by Thompson cut machining and finishing costs.

Today, our capacity is channeled to top-rated jobs. We're building additional facilities as fast as possible and, in the meantime, Thompson services, as always, are at your command. Our entire staff of creative engineers is ready to help you plan new parts or re-design old ones for the future.

YOU CAN COUNT ON . . .

Thompson Products, Inc.

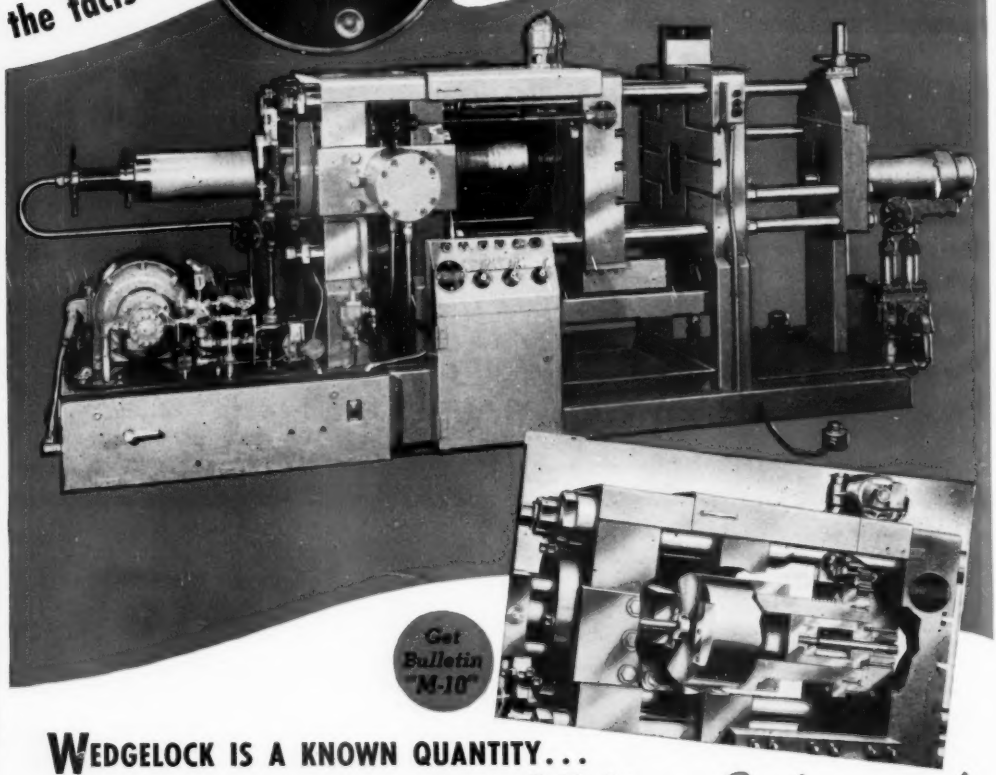
2269 Ashland Road • Cleveland 3, Ohio

LIGHT METALS DIVISION

For additional information Circle No. 33 on the Reader Service Card

Get ALL the facts on WEDGELOCK

A *Premium-Built* DIE CASTING MACHINE



Get Bulletin "M-10"

WEDGELOCK IS A KNOWN QUANTITY...

the product of a *25-Year Background*

Deliberately, Wedgelock was designed to produce denser castings and more of them, to cut maintenance and down-time, and to deliver longer, trouble-free service. The die opening can be set at any point from 10" to 15". A shallow cavity can be run at a 10" opening for faster cycling and increased output. Motorized central screw adjustment (exclusive) regulates die height, making possible adjustments to .001". No toggle links to wear and replace; hydraulic ejection built into machine. Adjustable relief valve permits adjustments for 1000 to 2000 p. s. i. on shot cylinder. Pressures up to 40,000 lbs. are held without flash. Powerful hydraulic cylinders insure positive, direct locking; dense, solid castings and longer die life. *Get all the facts NOW.*

WEDGELOCK

Cuyahoga Industries 17920 WATERLOO ROAD CLEVELAND 19, OHIO

FOR SOUND, USABLE DIE CASTINGS

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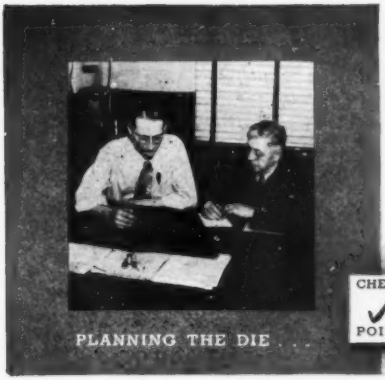

PLANNING THE DIE . . .

PARKER'S

CHECK ✓ POINT

16-POINT
PRODUCTION CONTROL SYSTEM WORKS FOR YOU!

The Finished Casting

WHEN you place your Die Casting order with Parker, a unique control system goes to work for YOU. From the original planning stage through the finished casting, 16 important check points assure perfect castings. Every phase of production is carefully checked so that alloys, tolerances and designs meet the most exacting requirements. This 16-Point Production Control System is a result of Parker's half-century of experience—another example of how that experience pays off for YOU.

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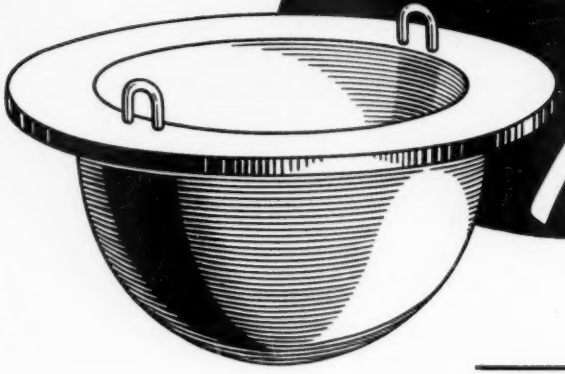
And when you think of Die Castings **- - THINK OF**

PARKER ALUMINUM and ZINC *Die Castings*

For additional information Circle No. 27 on the Reader Service Card

FOR THE BEST IN MELTING EQUIPMENT SPECIFY *Milles*



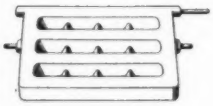
COMPLETE LINE OF MELTING EQUIPMENT FOR DIE CASTERS, NON-FERROUS FOUNDRIES, AND SMELTERS

• Melting Kettles • Ingot Molds • Pallet Molds • Slag Buggies • Enameled Ladle Bowls • Enameled Kettles • Enameled Thermocouple Protecting Tubes • Milles "Ferrisist" Ladle and Kettle Wash • Enameled Pouring Ladles • Salem Pressed Steel Ladles • Melting Kettles and Skimmers • Universal Mold Compound

Get Catalog No. 101 for detailed information on our complete line of melting equipment.

NEW YORK REPRESENTATIVE—FRED W. HARMON
15 ARDMORE ROAD • SCARSDALE, NEW YORK
TELEPHONE 3-6669

1. IRON OR PRESSED STEEL POURING LADLES



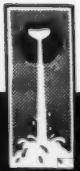
4. WATER COOLED MOLDS

2. PRESSED STEEL LADLES

5. IRON MOLDS FOR ALL NON-FERROUS METALS

3. CAST IRON POURING LADLE

6. THERMOCOUPLE PROTECTING TUBES. STANDARD TUBES ARE 1⅝" O.D. THREADED FOR ¾" PIPE. STANDARD LENGTHS RUN FROM 12" TO 48"



C. H. MILLES FOUNDRY COMPANY

MANUFACTURERS OF SPECIAL ALLOY HEAT RESISTING IRON

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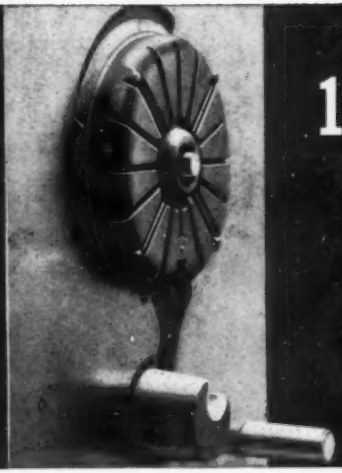


1,300,000 CASTINGS FROM THIS DIE-

Since Sept. 1947

CASE HISTORIES FROM MT. VERNON FILES

Here at Mount Vernon, we are proud of our long-lived dies that "stand the gaff", exceed normal life expectancy despite the severe punishment of continuous operation. The one pictured has duplicated the casting shown more than 1,300,000 times—and this die is still in use.

Die casting affords two outstanding production economies: (1) rapid production; (2) reduced machining and finishing.

Both advantages are fundamental factors in establishing lower unit costs. But the degree to which savings may be realized depends upon the quality of the workmanship in making the dies and the care with which they are used. Dies that retain their accuracy for longer periods—yield clean, flawless castings day in and day out—quickly write off initial costs, and reduce ultimate costs appreciably.

If you have not already profited by the economies to be gained from die casting, consult with us. We are confident that, with our comprehensive experience, skills and modern facilities, we can show you the way to increased output at lower cost.

MT. VERNON
DIE CASTING CORP.
MT. VERNON NEW YORK

Produced for The Apex Electrical Mfg. Co.
Cleveland, Ohio

For additional information Circle No. 24 on the Reader Service Card

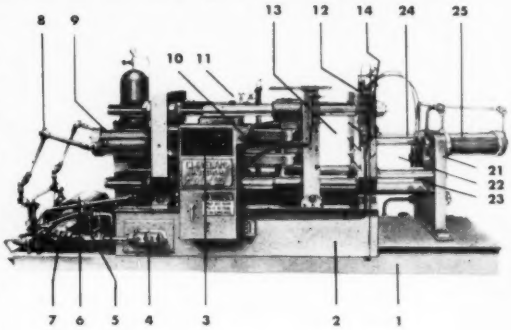
Why you can count on CLEVELANDS

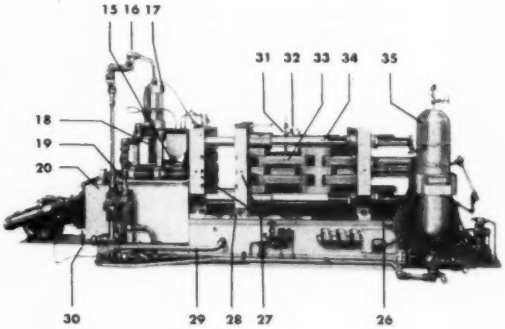
to give you precision quality die castings at a highly profitable rate of production

35 POINTS OF DESIGN AND CONSTRUCTION SUPERIORITY have made Cleveland Die Casting Machines the leader in this field. Many of these features are exclusive with Clevelands . . . others were pioneered by Cleveland and are now in general use throughout the industry. *All* add up to give Clevelands the qualities so essential for successful die casting:

- Rugged, rigid construction throughout for dependable, economical performance
- Powerful die locking pressure
- Fast, shockless die closing and opening for high production operation
- High metal injection speed to produce sound, dense, "hardware finish" castings
- Safe and simple control—manual or automatic
- Ample elbow room for die mounting and machine maintenance
- Universal construction — easily convertible — for either hot or cold chamber operation

These are the reasons why Clevelands are selected by many of the nation's most experienced die casters . . . why *two* of the country's foremost die casting producers have installed 32 Clevelands each . . . and a *third* has installed 33! And why Clevelands can be found in 'round-the-clock production in 12 foreign nations as well. Let a Cleveland Engineer show you how Cleveland Machines can improve your production with money saved!





MAKE A POINT-BY-POINT COMPARISON OF CONSTRUCTION FEATURES . . . THEN YOU'LL CHOOSE Clevelands!

Bulletin 400 gives you complete details. Write for your free copy.

Photographs above, with 35 points of Cleveland superiority indicated, show front view of the widely-used Cleveland Model 400 with aluminum shot end, and rear view of the Model 400 with zinc shot end. Cleveland Model 400 has 36" x 38" die plates; 400 tons locking pressure. Other Cleveland machines include the Model 200, 30" x 31" die plates; Model 100, 22½" x 24½" die plates; Model 50, 18" x 22" die plates.

QUICK DELIVERIES NOW POSSIBLE ON MOST MODELS

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
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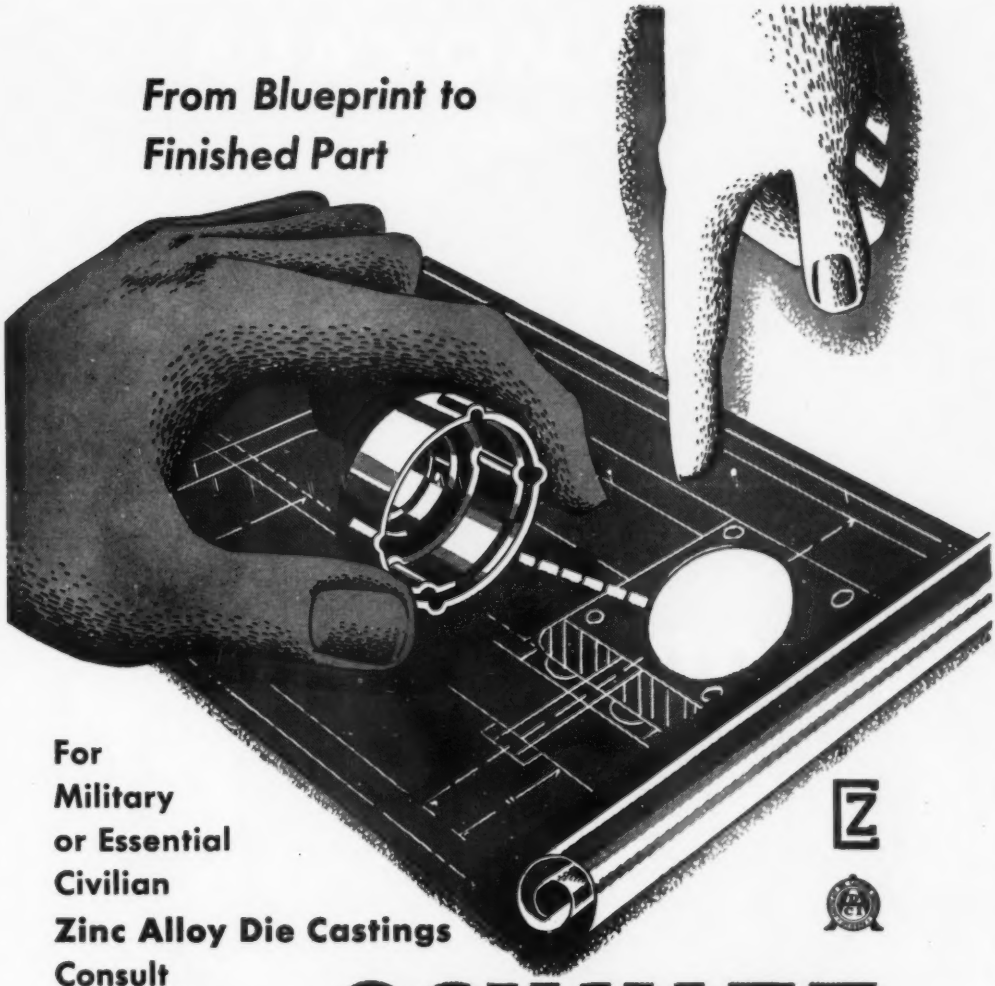

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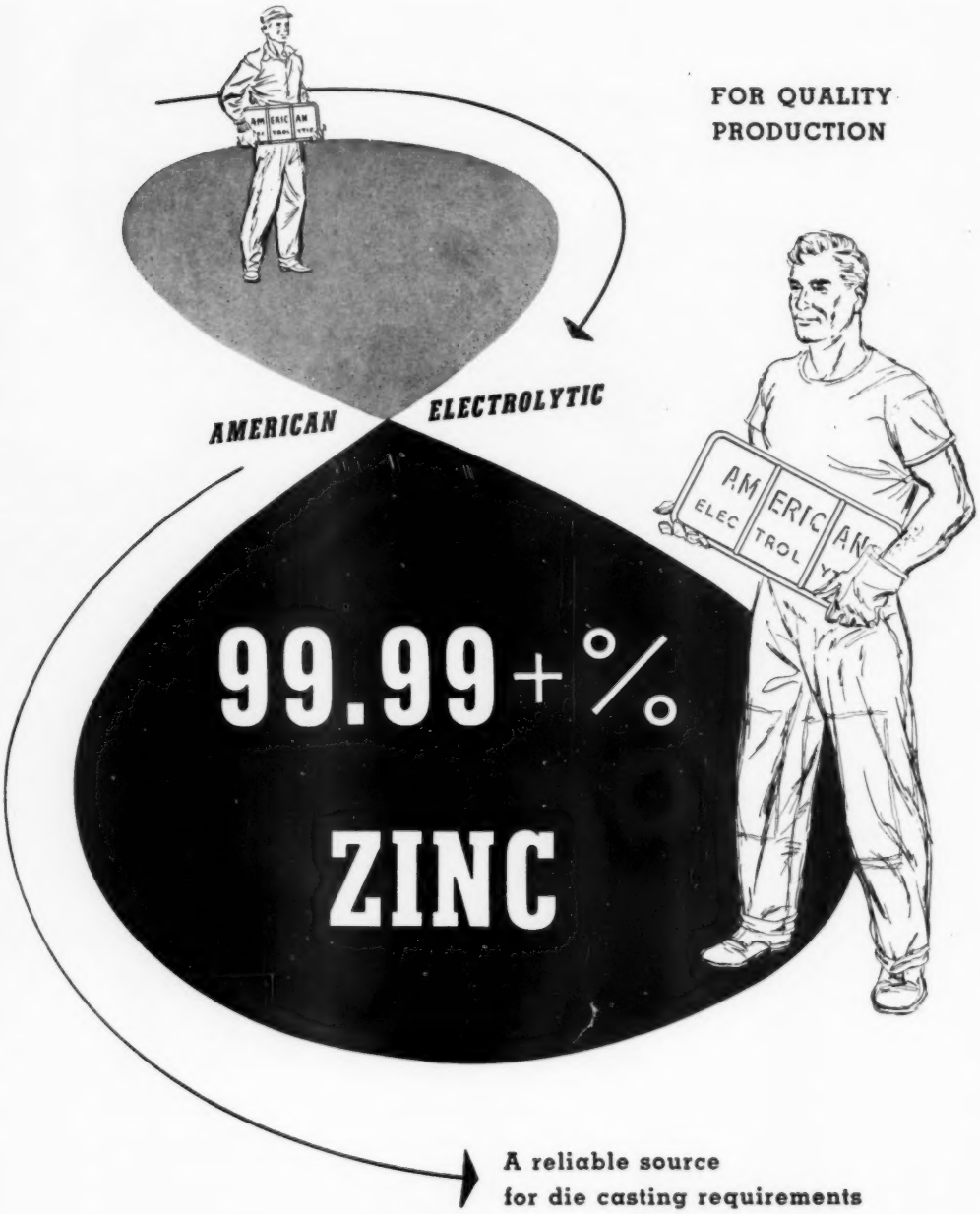

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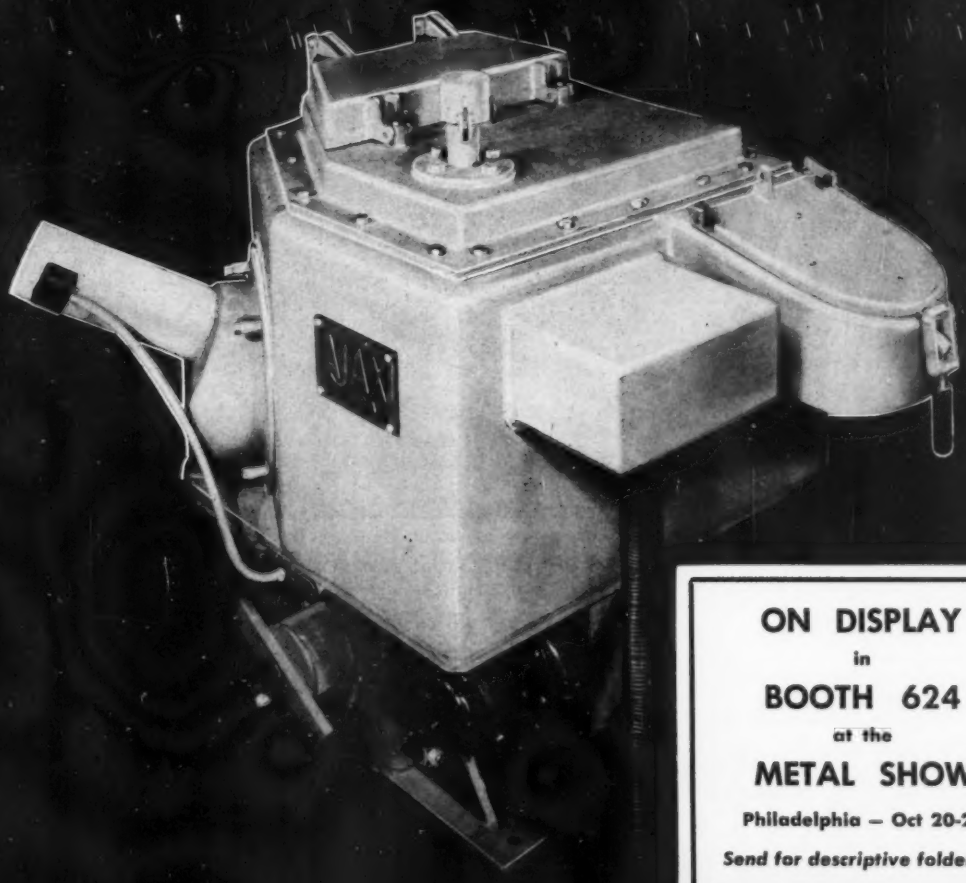

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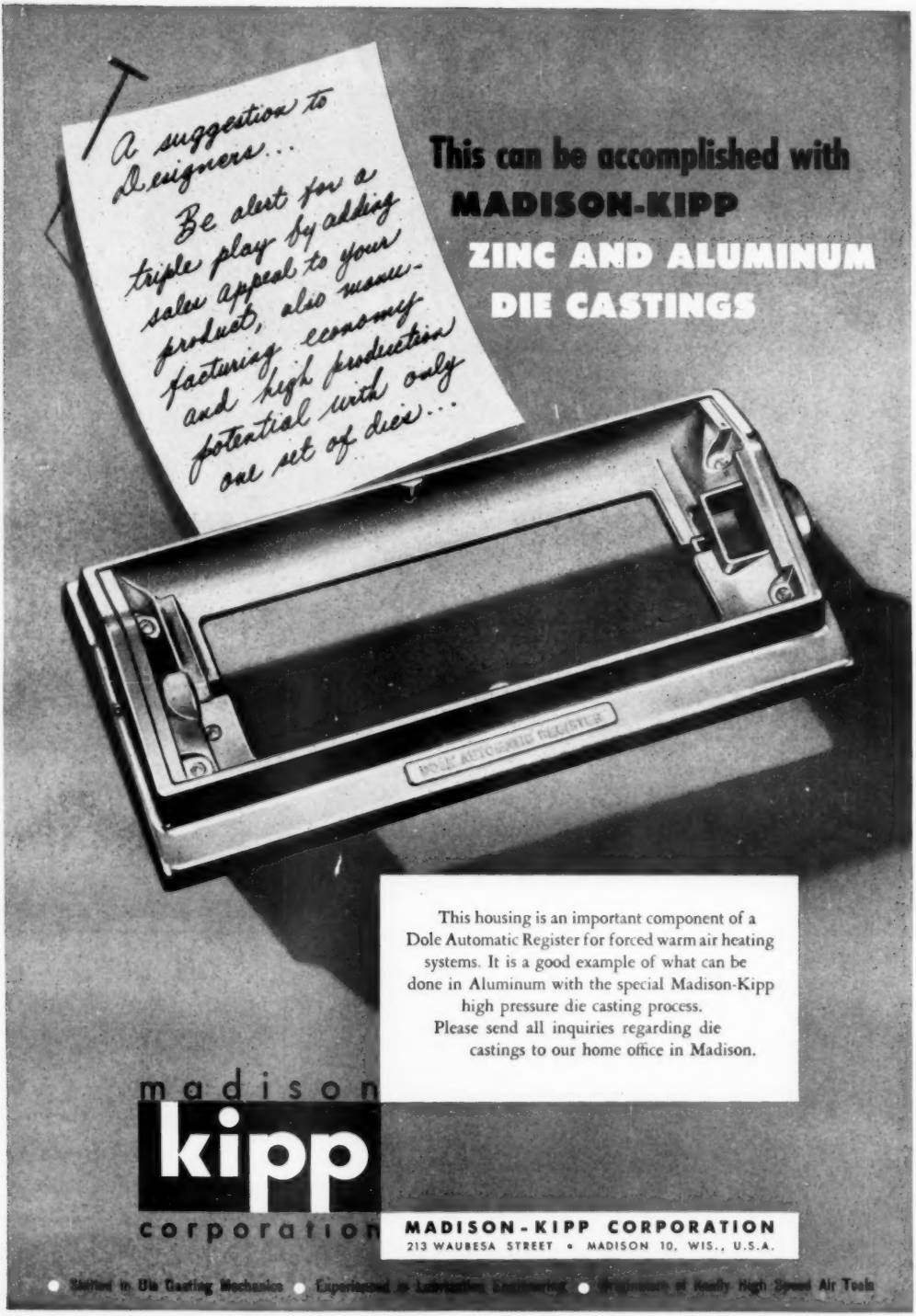
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IRON POWDER pinion outperforms cast iron

ONE of the principal applications to which powder metallurgy is being put is in the fabrication of iron parts that were formerly made as iron castings. In many cases where the casting is relatively small and requires at least some machining after casting, powder metallurgy has been able to show important cost reductions. In addition to cost reduction, however, the substitution of an iron powder part for a machined casting has allowed a greater flexibility of design.

An example of both of these advantages is shown in the wheel drive pinion for a power lawn mower made by the Jacobson Mfg. Co. of Racine, Wisc.

In the days of "one man power" lawn mowers, perfection of tooth contour, precise dimensional tolerances, and smooth and uniform cam surfaces were not as important as today. With power driven mowers, however, all of these factors have become important due to the higher speed of operation and the greater use of the mower than formerly.

When cast iron pinions were used and then machined to the desired tolerances, the scrap loss due to defective castings rapidly became intolerable. A change was made, therefore, to a pinion made of 80 percent iron powder and 20 percent copper powder.

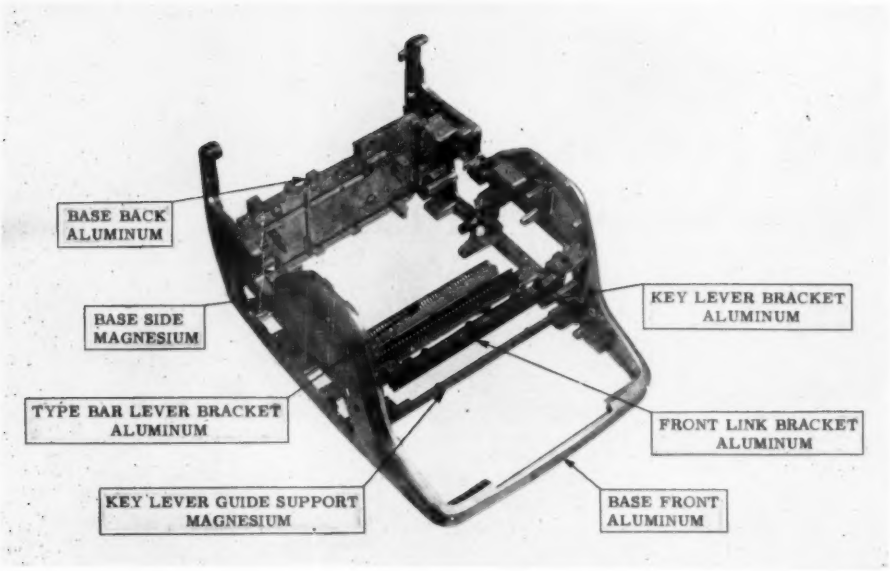
A typical pinion made of the powder mixture noted is shown in Figure 1. As fabricated by the Powdered Metal Products Company of Franklin Park, Ill., the pinion requires only a single machine operation, reaming of the bore, to ready it for hardening prior to assembly in the mower.

Unless otherwise specified, all decimal dimensions are held to ± 0.003 and fractional dimensions to ± 0.10. Departures from these general specifications are found in the O.D. and parallelism of the pawl pockets.

To secure adequate strength and good wear resistance, the pinion has to be hardened. For this application, case carburizing is adequate. The pinions are heated in liquid cyanide at 1550 F for two hours, then cooled to 1000 F, reheated to 1480 F and oil quenched. This heat treatment gives a part having a case depth of 0.030 and a case hardness of at least 90 Rockwell B. No tests are made to determine the physical strength of the powder part, but a rough test of tooth strength is made by an impact test. Purely arbitrary testing methods are used and the only requirement is that the powered metal pinion be stronger, under impact, than its cast iron counterpart. This condition is easily achieved.

The cost picture for these pinions is rather complex. If there were no rejects in the cast iron parts, the cost would be about the same for the two. Due, however, to the large numbers of rejects, the powdered metal pinion is considerably less costly when ready for installation. Of equal importance is the number of machine tools that would be tied up on pinion machining if cast iron were used that are now free for other uses. The inspection load has also been materially reduced, another very real saving, but one that is hard to evaluate.

The above savings, coupled with the better, quieter and smoother operation of the mower, amply justify the use of powder metallurgy as a fabricating method for this part.



When converting to MAGNESIUM DIE CASTINGS use the galvanic series as a guide

By J. F. KLOSKI*

FOR one reason or another, some industries today are changing from aluminum to magnesium die castings. In some cases, the change is temporary and in others, the advantage of magnesium die castings are such that the change will be permanent.

If a cold chamber machine has been in use for making the aluminum die castings, this conversion can be accomplished with little or no alteration in the dies. If, however, a gooseneck machine is used for making the aluminum castings, it is probable that new dies would have to be made and the magnesium parts made on a cold chamber machine.

From the die caster's point of view, there is little difference between making a part of aluminum and magnesium. If anything, magnesium flows a little better, the dies require less frequent lubrication and where long thin sections introduce the possibility of cold shuts in an aluminum casting, the danger of these is materially lessened in magnesium.

The handling of magnesium is, however, somewhat more difficult; generally a somewhat lower casting rate results so that the gain due to improved castability is offset by the slower processing.

As far as the dies themselves are concerned,

*Superintendent of Engineering, Royal Typewriter Company.

little if any change needs to be made. Occasionally, some slight modification of gates and risers is necessary, but this is a rather rare occurrence.

At today's market there is about 10c per lb. price differential between aluminum and magnesium, but the difference in weight for the same volume of metal just about compensates for the price difference. The net result, therefore, of a conversion from aluminum to magnesium at the foundry level, is to provide castings of a non-allocated material at only slightly increased cost.

This conversion from aluminum to magnesium die castings was recently made by the Royal Typewriter Co. of Hartford, Conn. In spite of the fact that the magnesium castings as received from the vendor, the Doehler-Jarvis Co. of Toledo, Ohio, were only 27c more than the aluminum castings formerly supplied, there has been a greater increase in cost due to the difference in the handling of the magnesium after it is received.

The outstanding problem with regard to the use of magnesium is its high chemical activity. As is well known, magnesium oxidizes rapidly even in dry air and unlike aluminum, the oxide film formed is non-protective. As a result, unless some protective treatment is given the die castings, there is a tendency for continued oxidation which can ultimately result in the destruction of the part; at least, the oxidation can be sufficiently severe to shorten the life of the casting very materially. Either a dichromate or phosphate surface treatment is adequate to stop surface oxidation and at Royal Typewriter Co., the phosphate treatment is preferred.

Of more importance, and it might be added, trouble and expense, is the galvanic corrosion that takes place when magnesium or magnesium alloys are coupled with another metal in the presence of an electrolyte. Unfortunately, even humid air is an adequate electrolyte to start the galvanic corrosion of magnesium if it is coupled with another metal that is widely separated from it in the galvanic series. This galvanic series with sea water as an electrolyte is given in Table 1. While there may be some variation with a different electrolyte, this table can serve as an adequate guide when magnesium castings are exposed to normal industrial atmospheres, especially humid ones.

On the typewriter base shown in Figure 1, all of the conversions that have been made are shown. The two base sides were formerly aluminum die castings and are now magnesium. All of the cross members shown have been changed from cast iron to either aluminum or magnesium as shown.

Where the magnesium members of the base are in contact with aluminum, the galvanic corrosion is rather slight and a painted surface of contact is adequate to inhibit any activity. Where, however, machine screws, pins or similar fastening devices are used, a better protective film is required from both a mechanical and chemical standpoint. All such

continued on page 108

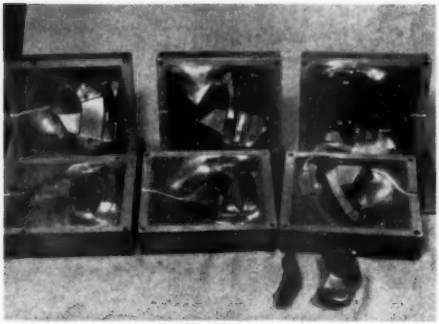
TABLE 1
GALVANIC SERIES IN SEA WATER

ACTIVE OR ANODIC METALS		
Magnesium	Cast iron	Admiralty brass
Magnesium Alloys	Ni-resist	Red Brass
Zinc	13% Chromium stainless, type 410 (active)	Copper
Galvanized steel or wrought iron	50-50 lead tin solder	Silicon bronze
Aluminum 52SH	Type 304 stainless (18-8) (active)	Ambrac (5% zn, 20% Ni, bal. Cu)
Aluminum 4S	Type 316 stainless (18-8, Mo) (active)	70% Cu, 30% Ni
Aluminum 3S	Chromium (active)	88% Cu, 2% Zn, 10 Sn%
Aluminum 2S	Lead	88% Cu, 3% Zn, 6.5% Sn, 5% Pb
Aluminum 53 S-T	Tin	Nickel (passive)
Alclad	Muntz metal	Inconel (passive)
Cadmium	Manganese bronze	Monel
Aluminum A 17 S-T	Naval brass	Type 304 stainless (passive)
Aluminum 17 S-T	Nickel (active)	Type 316 stainless (passive)
Aluminum 24 S-T	Inconel (active)	Chromium (passive)
Mild steel	Yellow brass	Passive or cathodic metals
Wrought iron		

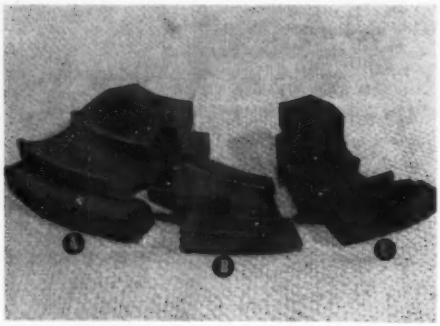
Note: Some variation in order will occur depending upon the electrolyte. Galvanic corrosion will occur between any anodic metal and another below it in the table. The farther apart the two metals are, the greater the galvanic corrosion will generally be.

(From—Kent's Mechancial Engineers' Handbook, 12th Edition, Pages 3-19)

How a wax pattern is set up . . .



1. THREE DIES are required to form the patterns shown in Figure 2, which are used in producing the investment casting for a jet engine nozzle diaphragm . . .



2. PATTERN IS ASSEMBLED from 15 separate wax patterns — including three of (A), three of (B) and nine of (C). Ability to withdraw pattern from the die determines way pattern is divided . . .

How precise is INVESTMENT CASTING?

By **PHILIP R. KALISCHER**
Associate Editor

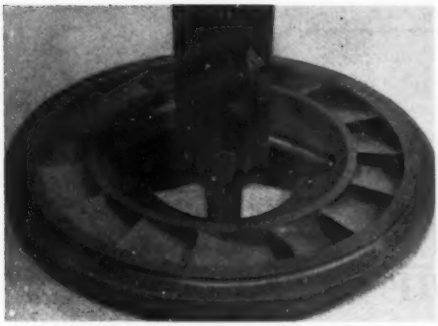
THE term "precision" when applied to a metal-forming process is entirely relative. In terms of dimensional tolerances, it may mean ± 0.001 to a machinist or ± 1/16 to the foundryman. It may mean dimensional reproducibility from part to part within given tolerance limits as wide as those just indicated with no particular reference to individual dimensional tolerances on any one piece.

"Precision" may also vary depending upon the contour of the piece being made. Depending upon both the shape and the end use of a product, a variation of ± 0.001 may be a high degree of precision in one case and sloppy loose in another. To apply the term, then, to the investment casting of metal parts without any qualifications is inviting misconception and trouble. This loose application of terminology has led, in the case of this casting process, to an erroneous idea in the minds of many engineers and designers as to just how exact the method may be.

This same misconception of "precision" has led to the misapplication of investment cast parts with the inevitable bad taste left in the mouths of the men who misapplied it.

The fault lies primarily in the over-enthusiasm of some proponents of investment casting. There has been, in all probability, no deliberate attempt to mislead a prospective user, but in the effort to sell the process, claims and promises completely unobtainable commercially have been made.

The author has, for example produced castings in a laboratory where some individual dimensions were held to less than ± 0.001 and where the reproducibility of a single dimension in a selected group of castings was within ± 0.002. To do this same job on a com-



3. FINISHED PATTERN with all joints waxed smooth is shown above. The necessary sprues and risers are then added to make the pattern ready for processing through other operations . . .

4. GAGING FIXTURE is used in assembling the wax patterns to attain tolerance of .010 required by the customer. Skilled workmanship and extremely careful inspection are essential.

mercial scale, however, would be economically impossible since it might mean scrapping as much as 90 percent of the production. Unfortunately, however, some writers and lecturers on investment casting have given the impression that accuracy such as indicated above can be held consistently on a commercial production scale.

In view of these mistaken impressions, it will be well to examine the process critically and to determine just what the commercial limits of accuracy are. To determine what general types or classes of parts might logically be made as investment castings, and what sort of properties can be expected of the castings.

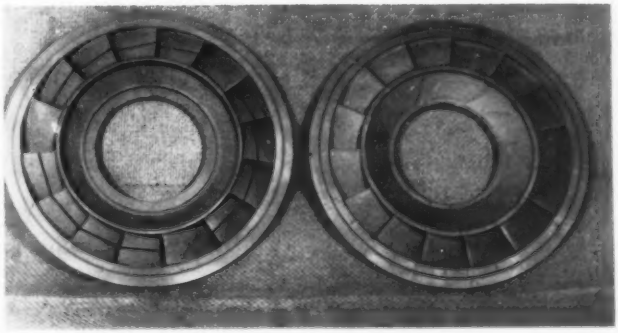
Dimensional tolerances and reproducibility

Any process that is dependent for dimensional accuracy on the maintenance of precise temperature control, particularly when the transformation from liquid to a solid phase is involved, has imposed upon it certain limitations beyond any normal control. An attempt to control temperatures closer than ±10 to ±15 F increases operating costs to such an extent that the process soon becomes economically unsound. Consider, for example, the effect of a change of only 15 F in the temperature of the wax used when it is injected into the mold to make the disposable pattern. With the normally used waxes, this can amount to a change in a three-inch length of ± 0.002.

Again consider the effect of a 50 F change in the temperature of the molds just prior to pouring the metal. Today's investment materials may well show another dimensional change in

continued on page 99

. . . to produce a complex investment casting

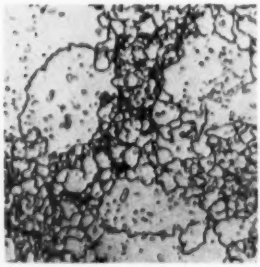


5. AFTER CASTING, the piece is finish machined. Shown at right are two views, as cast and as machined. All photos on these pages courtesy of Michigan Steel Casting Company of Detroit, Mich.

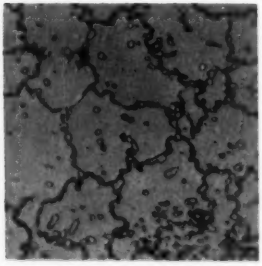
Progress report on hot forging PREALLOYED METAL POWDERS

By LAMBERT H. MOTT*

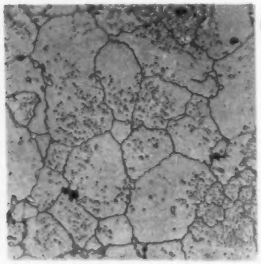
1. HOMOGENIETY OF GRAIN size immediately after hot coining. 500X



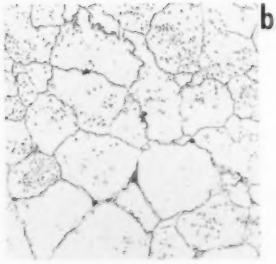
2. AFTER HOMOGENIZING heat treatment, particle-to-particle interfaces are not visible. 500X



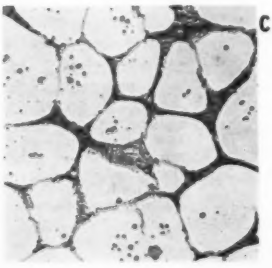
3. TRANSITION STEPS to grain boundary carbbide condition are show in photo-micrographs below. 500X



a.



b.



c.

THE recent development of prealloyed powders, each particle of which is in really a tiny ingot, has enabled the powder metallurgist to design methods of fabrication directed toward the manufacture of high strength, high density, heat treatable objects from metal powders. Prior to this development, alloyed metal objects manufactured by powder metallurgy techniques were limited primarily to low melting point alloys where an addition or liquid phase of a lower melting point constituent might be present during the sintering operation. With few exceptions, it was impractical to produce from primary component powders, parts of steel, for example, where long time, high temperature sintering and heat treatments were necessary to effect a completely homogeneous material that could compete metallurgically and physically witn the wrought alloy.

Today, however, with the availability of prealloyed powders, the problems of the powder metallurgist are considerably simplified, and resolve themselves into the design of a method for the elimination of the voids within the porous preform. Two general principles for obtaining completely dense parts have recently been developed and rely respectively on the elimination of porosity by pressure and plastic deformation, or by filling the voids with a separate lower melting point alloy composition. The latter process is generally known as "infiltration", and the former process, with which this paper deals, is known as "hot coining".

*Research Engineer, Powder Metallurgy Laboratory, Stevens Institute of Technology.

The hot coining process

The hot coining process in essence, consists of four basic steps which may be listed as follows:

Briquetting. This step consists of compacting the prealloyed powder at room temperature, into the approximate form of the finished part. The briquette thus formed is approximately 70% dense and contains sufficient weight of material to form the finished object plus flash. The form of the briquette is calculated so that it will fit into the forging die when the briquette is heated in Step 2.

Heating. The green preform is heated in a carefully controlled atmosphere for a predetermined length of time, to a temperature somewhat above the normal forging temperature of the alloy under consideration. During this process, some sinter bonds are established between the individual powder particles and dimensional shrinkage usually occurs. At the end of the preheating time, the hot porous preform is quickly removed from the furnace hearth and positioned in the die used in Step 3.

Coining. This step consists of coining the hot preform into final configuration and size under either an impact blow or fast acting mechanical pressure. During this coining operation, all voids in the material are forged out, resulting in a completely dense material and in a shape corresponding to that resulting from the final finishing blows of a normal forging operation.

Finishing. This step consists of the standard finishing operations employed in conventional forging practices such as trimming, de-gassing, heat treatment, etc.

When hot coining was first conceived, it was thought that the coining operation could be continued in completely enclosed dies, thereby eliminating the necessity of the trimming operation, but experience has shown that hydrostatic pressure alone will not bring about the desired densification of the porous preform. It was found that metal movement similar to that in shear, was essential to the removal of the last increments of porosity.

At first glance, the process appears to be a simple forging operation, but closer examination of the physical phenomena involved revealed the presence of a number of factors which complicate the picture.

First of all, it must be remembered that the initial structure is a porous material and hence subject not only to surface oxidation and scaling, which could be removed by a simple pickling operation, but

continued on page 89

TENSILE PROPERTIES AT ROOM TEMPERATURE

TABLE I

Average Tensile Data
Hot Coined and Heat Treated Alloy X-40

Density g/cc.	Heat Treatment	Tensile Strength Psi.	Elongation %	Reduction in Area %
8.52	(C)	140,200	4.6	5.4
8.33	(B)	92,100	5.6	6.2
8.46	(A)	162,500	23.5	18.6
8.61	(D)	101,000	11.0	14.0

(A) 2250°F. 2 hrs. Jacket cooled.*
(B) 2250°F 2 hrs. Water quenched aged 1500°F. 16 hrs.
(C) 2350°F. 2 hrs. Jacket cooled.
(D) "As cast".

COMPARISON OF SHORT TIME ELEVATED TENSILE TESTS

TABLE II

Elevated Temperature Tensile Data
Hot Coined And Heat Treated Alloy X-40

Heat Treatment	Test Temperature	Tensile Strength Psi.	Elongation %	Reduction In Area %
2250°F. 2 hrs.	Room	162,500	23.5	18.6
Cast	Room	101,000	11.0	14.0
2250°F. 2 hrs.	1500°F.	55,700	30.6	41.9
1350°F. 2 hrs. cast	1500°F.	59,500	8.5	13.7
2250°F. 2 hrs	1600°F.	46,200	27.1	37.8
1350°F. 16 hrs. cast	1600°F.	48,600	14.3	18.1

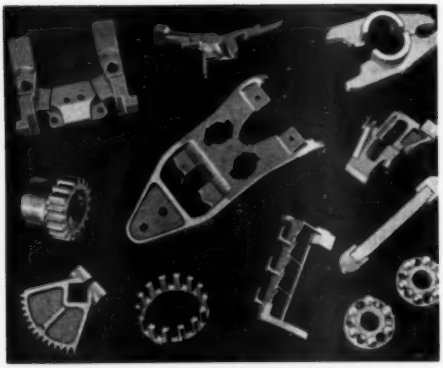
* Allowed to cool to room temperature in water jacketed portion of furnace tube.

STRESS-RUPTURE TEST OF HOT COINED VS CAST PIECES

TABLE III

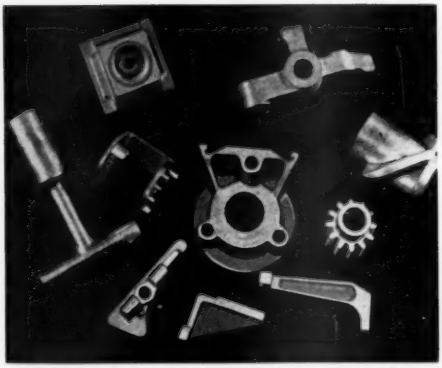
Stress-Rupture Properties of Hot Coined Alloy X-40

Specimen Treatment	Hot Coined	Cast
	Solution Treated 2250°F. — 2 hrs. Aged 1350°F. 16 hrs.	Aged 50 hrs. 732°C. — 815°C.
Stress — Psi.	28,000	28,000
Temperature — °F.	1500	1500
Rupture Life — hours	103	100
Elongation — %	5	12



HIGH TENSILE MANGANESE BRONZE can readily be cast in plaster molds, as indicated by the group of pieces shown above.

HOW PLASTER

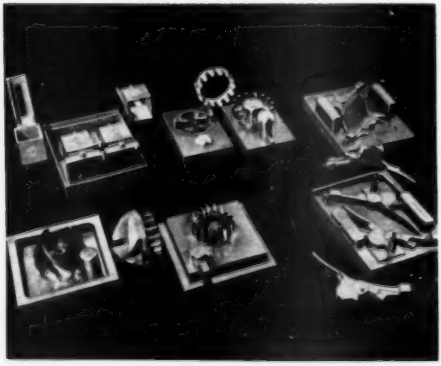


FORM AND DETAIL OBTAINED by plaster mold castings are excellent, regardless of the non-ferrous alloy chosen. Shown above are nickel alloys, silicon bronze and beryllium copper.

THE advantages of the plaster mold casting process described in the preceding installment are inherent in the techniques and in constant adherence to a high standard of quality control.

Alloys are supplied in pig form with chemical certification and an affidavit verifying nominal chemical analysis of the materials used for any casting is available on request. Heat control using high precision instruments and careful housekeeping combine to produce a high uniformity of casting.

The castings, in an as-cast state, cost less than others requiring machining to achieve dimensions and finishes natural



DIE PATTERNS for plaster mold casting are made in split style with each half mounted in precision-ground unit strip. Life of these brass patterns is unlimited since they are not subjected to abrasion, pressure or shock. It is usually unnecessary to make new die patterns when modification in design is required, for such changes can be made economically by altering the original die patterns.

All photos courtesy Atlantic Casting & Engineering Co., Clifton, N. J.

MOLD CASTINGS can solve unusual problems: Part 2 - Alloys

. . . a review of some outstanding applications, castable alloys, physical properties, methods of casting and and process advantages.

to the plaster mold process. The initial investment is appreciably lower than in most other precision casting processes, because it is possible to make a small unit strip of patterns rather than a full gate the size of the flask. Of course, full gates of patterns are used where extensive production is required and it always is least expensive where the volume will permit amortization of the higher tool cost. Even so, the cost of the full gate of patterns is less than the cost of certain dies, because the material used is easier to handle and costs less to start with.

Castings are sold by the piece, and among the factors which govern their cost are economy of layout, complexity, the number of cores involved, weight, and the quantity of a production run.

As an order for any one piece is completed, the pattern is removed and another placed in the same space. This flexibility which is available in alloys run in open flasks, reduces the investment required in die patterns. The mold is used but once, assuring an accurate cavity for each part or heat poured. The casting delivered can be accurately located in jigs and fixtures without preliminary fitting.

Almost any combination of copper, tin, lead and zinc that has a lead content of no more than 3 percent and a pouring temperature that does not exceed 2300 degrees can be cast in plaster.*

The following alloy specifications are indicative of the range and uses of alloys in current production:

No. 10 YELLOW BRASS (open flask) with a strength in excess of the usual 60-40 alloy group. It is free cutting and has complete freedom from dross and other inclusions which add to the cost of handling brass cast by other methods. Its fine grain structure permits it to be used for parts requiring tightness and easy machinability. It is free from porosity, has a surface which lends itself to polishing and plating with a minimum of work, and eliminates the loss of parts after machining or grinding. The No. 10 alloy has excellent fatigue qualities and negligible internal stresses which, combined with uniformity and strength, make it an all-purpose alloy for brush boxes, gears, levers and other general machine parts.

No. 20 ALUMINUM BRONZE (full flask) a strong, light zinc-free alloy with excellent corrosion - resisting characteristics. Lighter in weight than most other copper alloys, it machines well and has fine wearing qualities. It is a fine gear and bearing alloy. It is somewhat difficult to cast successfully unless a full gate of die patterns is used because exceedingly close control must be exercised during melting and pouring operation.

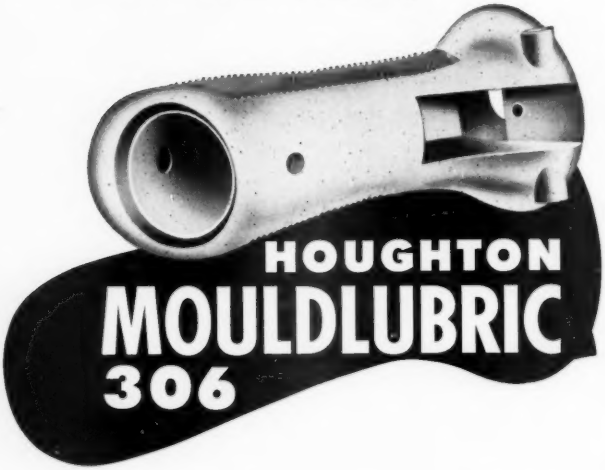
It is used for gears, sprockets, control levers, bearings, marine equipment, acid resisting pump parts, wing nuts, universal joints, and castings that must maintain strength and ductility at elevated temperatures.

No. 31 HIGH TENSILE MAGANESE BRONZE (open flask) is used when great endurance is required. It requires no heat treatment to attain its high physical properties. Through

continued next page

*For a chart of alloys, together with their physical properties, turn to page 99.

Now your die castings clean easier . . . come out free from stains!



keeps castings bright as it lubricates!

BRUSH ON paste-type Mouldlubric 306 for dies casting zinc or aluminum.

SPRAY ON heavy oil Mouldlubric 306L for dies used with zinc or aluminum.

DIE CASTERS welcome the *silvery* color of Mouldlubric 306 as well as its many other benefits. This lubricant makes cleaning easy. Your castings are ready to use if no special finish is specified.

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exacting control of materials and all casting operations, it is possible to cast this alloy in thin sections and still retain all of its desirable features. No. 31 has found acceptance as an ideal material for gears, clip fasteners, valve bodies and electrical mechanisms where dependability is essential.

No. 40 HIGH STRENGTH ALUMINUM TENZALOY (open flask), a zinc aluminum alloy which attains its high physical properties through natural aging. It comes up with a fine silvery surface and can be handled for most work where sections are not too thin or too thick. Physical characteristics of this material can be improved by artificial heat treatment, if desired, with very little loss in elongation. As cast, this alloy has freedom from internal stress and skin hardness, making it an ideal machining material.

It is used for communication, instrument and pump parts, aircraft fittings, cylinder heads, torque converters, impellers, and other applications requiring high strength and light weight.

No. 60 ALUMINUM ALLOY (open flask), a silicon aluminum alloy whose fluidity in the molten state in combination with the insulating quality of plaster molds permits production in accurate thin-sectioned castings. It has a clean, smooth surface and no skin hardness and lends itself easily to surface preparation. It can be machined to a very close tolerance. It is an excellent instrument alloy because of its uniformity, strength factor, and lack of internal strain in casting.

In addition to the alloys covered, the plaster mold process is capable of handling many other copper base alloys. Silicon bronzes, nickel bronzes and tin bronzes have been excellent answers to many special design problems when handled by this casting process. These special alloys are only handled on a full flask basis because of the necessity for exacting control.

Can thin walls, close tolerances and complex shapes be produced in aluminum alloy by means of permanent mold casting? This outboard motor builder says, "Yes."

PERMANENT MOLD CASTINGS used in an outboard motor

IN a number of instances, aluminum permanent mold castings have been used in building outboard motors with economy.

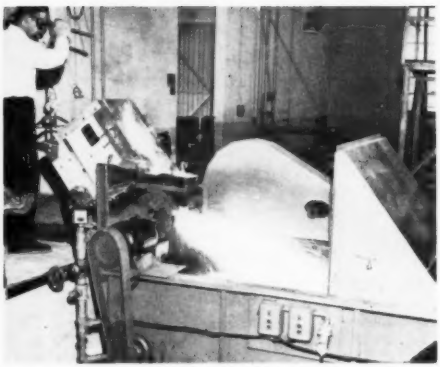
Two such examples are illustrated here. Both are components of outboard motors manufactured by Chris-Craft Outboard Motor Division in Grand Rapids, Mich.

The aluminum permanent mold propeller for 5 and 10 hp Chris-Craft motors is an unusual casting in that the dies for it are designed without backdraft. Its wall thickness in some sections is only .080, which is less than usual practice, and important tolerances are held somewhat closer than conventional limits. This is true especially on the clutch lands cored inside the hub. Weight and metal distribution are closely controlled for satisfactory balance characteristics.

The swivel bracket for a 5 hp outboard motor is also permanent mold cast because of a complexity of shape and coring that would push die casting die costs out of reasonable limits. One of the big attractions of permanent mold casting is the way in which the tooling is designed around the needs of the specific component, without undue attention to the requirements of a casting machine or core-pulling mechanism.

Finish on these castings is good enough that only a minimum of sanding or parting line cleanup is needed. Good strength and metallurgical properties are obtained. Both of these permanent mold castings are produced by the Aluminum Permanent Mold Company of Grand Rapids, Mich.

POURING INGOTS in open-top, core-sand molds provides convenient remelting sizes for the investment caster. Ingots are permanently identified, cleaned and stored for metallurgical approval prior to shipment.

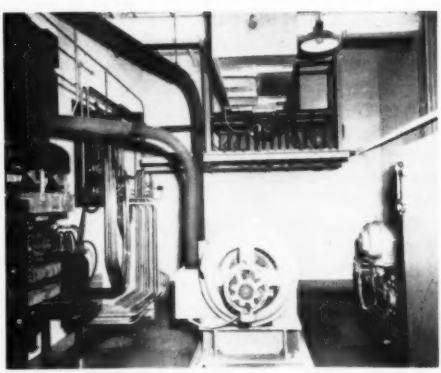


SPECIAL ORDER is shown here being shotted in a patented shotting machine. Production technique and metallurgical quality thus determined can then be duplicated in production furnaces.

Custom alloying for INVESTMENT CASTING widens designers' choice

CLOSE METALLURGICAL CONTROL is exercised in pouring from these high frequency induction furnaces. Thorough mixing action and close metallurgical control are features of this setup. Note metallurgist making final temperature check with optical pyrometer.

MOTOR GENERATOR ROOM supplies high frequency current to furnaces. Bus ducts, water cooled, connects throwover switch to furnaces through tunnel carrying water cooling pipe. Capacitors are hung overhead. Air conditioners are suspended from ceiling. All photos courtesy Cannon-Muskegon.



ONE of the prime advantages of the investment casting process — the almost unlimited variety of alloys that can be cast — brings with it a special problem for the investment casting foundry. Since it costs little more to investment cast alloy steels than low carbon steel, designers now seek to obtain corrosion or wear resistance in well finished, dimensionally-accurate, as-cast parts of quite intricate shapes.

Accordingly, the investment foundry is being called upon for more and more highly alloyed steels such as tool steel, stainless, and more recently the "super stainless" or cobalt and metal base alloys containing only traces of iron. But where does the foundry man go for raw materials?

The very nature of his work requires highly flexible, low capacity melting furnaces so that it is not technically and economically feasible to make up each heat by development from basic raw materials.

Difference between wrought and casting alloys lies in minor elements

Very often, melting stock may be obtained from mill or warehouse sources, but all too often the product of such sources is found not entirely suitable for the investment casting process. For example, the nominal 18-8 stainless steel is known to contain at least twice as many elements as its basic chromium-nickle-iron three. The proportion of these additional elements contributes importantly to the rolling or subsequent fabrication of a wrought steel, but are actually detrimental to the making of a good casting. In addition to making the production job distinctly more hazardous, the wrought steel proportions of alloying elements detracts from the best properties available in the finished casting. Better casting yield in the foundry and a better cast product for the customer are the result of using alloys designed for casting purposes.

A realization of the important difference between rolled steel and cast steel products and the significance of "minor" alloying additions is one of the marks of the advancement of the investment casting industry to a predictable science, for with this knowledge, both the product and the process have been improved to the point that the economics of investment castings has been improved.

This requirement, then, for metal tailored to the needs of the investment caster has been met by developing centrally located, specialized metallurgical manufacturing plants such as that of Cannon-Muskegon of Muskegon, Michigan, where a team of metallurgists has installed a battery of high frequency induction melting furnaces with both sampling size furnaces and production units.

Here the peculiar needs of the investment casting industry are studied and met by specialists interested solely in this growing industry. They offer alloys tailored for remelting, melting the generic, broad specifications of a particular class of metal. However, at the same time, each of the many minor alloying elements such as carbon, silicon, manganese, phosphorus, copper, sulphur, aluminum, etc. is adjusted to help the investment foundry increase its casting yield, decrease rejects, and improve the customer's product.

Every new industry has many obstacles, not the least of which is lack of concurrent development of raw materials or services it requires. Just as a highly technical industry newly established on one of the off-shore possessions of the United States recently suspended operations "because there were no corner hardware stores to give immediate service on the myriad of small emergency requirements", so a new industry is always handicapped until its importance has been demonstrated to have the potential for larger consumption of goods or services specially designed for it.

The investment casting industry has reached this point.

Melting stock specifically for the investment caster is now produced under close laboratory control in a plant designed for that purpose. The small melting equipment at Cannon-Muskegon produces the small quantity of special metal needed by the foundry for customer samples, which can then be exactly duplicated in the producton run. And, quite significantly for the foundry, since the production metal is identical to the sampling lot the lessons learned in foundry procedure on the sample are fully realized in the production run so that foundry costs are significantly controlled.

Small quantity deliveries for sample runs of new alloys

Another problem which the investment caster often faces is the need to submit samples of alloys other than those which he has in routine production. The ability to furnish sample castings in specified alloys at short notice is often the difference between getting or losing an order. This new service, with rapid delivery of alloys-to-specification, is expected to be helpful to the foundry and its customers.

Because exact quantities of alloys may be had without waiting to get into mill schedules, inventory burden on the investment caster is reduced. Another assist in the matter of inventory concerns the problem of gates

continued on page 110

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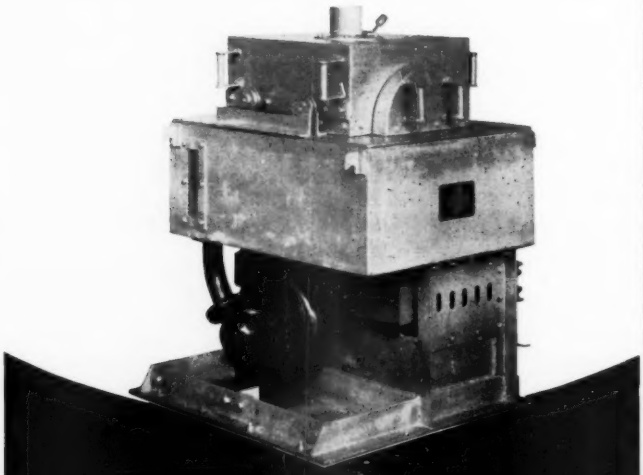

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NAVAL ORDNANCE DEVELOPS NEW MAGNETIC MATERIAL BY POWDER METALLURGY

A new magnetic material which exhibits a coercive force of 3000 oersteds, the highest recorded coercive force of any known permanent magnetic material, has been developed in the Magnetics Division of the Naval Ordnance Laboratory at White Oak, Silver Spring, Md. It has been named Bismanol from its composition of bismuth and manganese and NOL where it was prepared.

Because of this high coercive force Bismanol exceeds any other permanent magnet, except the platinum-cobalt alloy, in available flux density in short magnets where length to diameter ratio is one or less. Since Bismanol magnets are made by the powder metallurgy technique, complicated shapes can be processed to close tolerances without machining.

Bismanol, which is the material known to scientists as manganese bismuthide, was prepared as part of a search for a magnetic material not containing nickel or cobalt and which could be compacted in the form of fine particles to form permanent magnets. This particular combination of materials was choosen by the NOL researchers because of its potentially high magnetic crystal anisotropy, or, in other words, its possession of an axis along which magnetism is very easy as opposed to one or more other axes along which it is difficult. Permanent magnets are made taking this characteristic into account and aligning the crystals in so far as possible in the direction of easy magnetism.

Both bismuth and manganese are non-magnetic when alone. In the preparation of the magnetic alloy, powdered manganese and powdered bismuth are mixed and heated to about 700°C. Then the mixture is cooled to 400°C and aged at that temperature for from eight to 16 hours. The alloy than consists of the intermetallic com-

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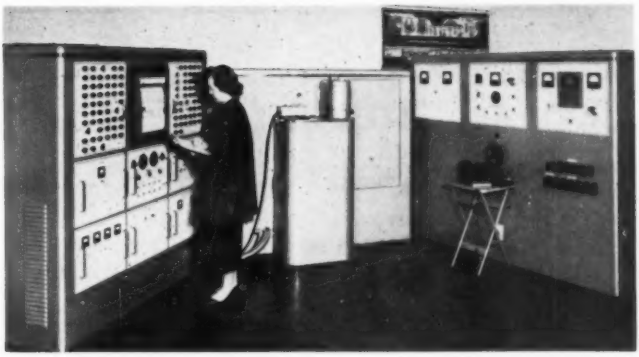
DIRECT-READING ANALYSIS as a means of production quality control has been an important factor in obtaining today's zinc die casting alloys with high physical properties. The ARL Quantometer discussed below, is illustrated at the right.



Quantometric analysis of zinc base DIE CASTING ALLOYS

By M. F. HASLER and B. R. BOYD*

THE analysis of the common grades of zinc die casting alloys has presented a unique problem to the control laboratory since their introduction to the metal industry some 25 years ago. Until that time, the zinc base alloys had been used rather sparingly and without a close control over certain undesirable aging factors which limited the usefulness of these alloys. Prior to 1925, the New Jersey Zinc Company undertook an extensive research project designed to ascertain the most useful combinations of the various alloying elements. In addition, this program set out to uncover the factors which had caused a continuous series of failures in all of the original zinc base alloys.

This research work resulted in the development of three standard alloy types containing different percentages of the alloying constituents Al, Cu, and Mg. During this period, it was determined that the failure of the older alloys was caused by the inclusion of small amounts of lead in the alloy. The cause for the failure was actually intragranular in nature, and resulted from a migration of the contained lead to the crystal grain boundaries upon aging. It was also established that cadmium and tin would produce similar deleterious effects in the structure. Heat and moisture in combination with these elements would accelerate this whole corrosion process. The noted effect of these elements immediately presented a problem to the manufacturer and to the control chemist. Table I shows the ranges of concentration for the common alloys.

*Applied Research Laboratories.

TABLE I

ELEMENT	CONCENTRATION RANGES		
	A.S.T.M.XXI	A.S.T.M.XXIII	A.S.T.M.XXV
Aluminum	3.5-4.5%	3.5-4.3%	3.5-4.3%
Copper	2.5-3.5%	.1% max.	.75-1.25%
Magnesium	.02-.10%	.03-.08%	.02-.08%
Iron	.1% max.	.1% max.	.1% max.
Lead	.007% max.	.007% max.	.007% max.
Cadmium	.005% max.	.005% max.	.005% max.
Tin*	.005% max.	.005% max.	.005% max.

*Some specifications call for lower lead, tin, and cadmium. Tin at .001% max. is the lowest.

This paper was presented before the American Association of Spectrographers, Chicago Chapter, May 13, 1952.

The manufacturer was faced with the difficulty of obtaining and using zinc of sufficient pur-

TABLE II

Source: Multisource C=40uf; L=350uh; R=50ohms
Sample: Chilled cast disk—top negative electrode
Counter-electrode: 1/4" high purity graphite rod with 120° cone—lower positive electrode
Electrode spacing: 3 mm
Pre-arc 2 seconds
Integrating time: 20 seconds
Recording time: 2.4 seconds per element or 17 seconds for 7 elements
Element lines and ranges:

Cadmium	2288.0A	.0005-.02%
Aluminum	2568.0A	2-6%
Magnesium	2795.5A	.01-.1%
Iron	3020.6A	.01-.1%
Tin	3175.0A	.0005-.02%
Copper	3247.5A	.01-.5%
Lead	4057.8A	.0005-.02%
Copper	5105.5A	.5-4%

Internal standard: Reflected beam from grating

ity to meet these new specifications. The control chemist, at the same time, was required to analyze the Cd, Sn, and Pb to unusually low limits, both in the pure zinc and in the finished alloys. One unusual thing about the zinc problem, from the spectrographic standpoint, is that the levels of concentration of the elements cover a very wide range. For example, it is necessary to analyze tin, in many cases, as low as .001 percent, and aluminum as high as 4.5 percent.

The chemical control of the low concentrations of cadmium, tin, and lead in both the pure zinc and in the alloys was time consuming and lacked sufficient accuracy for use on a control basis. During this early period, the potentials of the spectrograph were introduced into the field of metal control and the New Jersey Zinc Company immediately recognized its value.[1] The inherent concentrational sensitivity of the spectrograph proved of value in the solution of this impurity problem.

It is interesting to note that one of the first spectrographic procedures established in cooperation with the A.S.T.M. committee on standard analytical methods was the tentative method issued in 1935 for the "Spectrochemical Analysis of Zinc for Lead, Iron and Cadmium".[2] The method employed in this case consisted of a solution technique and used a visual comparison between a series of standards and a series of unknowns exposed on the same film or plate. Later modifications to the original method used photometric intensity comparisons to improve accuracies.[3]

Subsequent papers by several workers improved these earlier methods still further and placed more emphasis on the direct analysis of samples in solid form, either as pins or filings. During the past five or six years, additional progress has been made, through the use of conventional sources and through the development of special spectroscopic source units.[4,5]

The flat sample technique has been used to good advantage in many cases with greater ease of sample handling and increased speed of analysis.

One approach with conventional sources[6] is to use a high voltage spark for the analysis of the alloying elements—aluminum and copper—, and the impurities — iron and magnesium—, and to use a high voltage A.C. arc for the low concentration impurities—lead, cadmium, and tin. Another approach is to use a high voltage spark source with both high inductance and capacitance and analyse all elements with a single exposure. However, with this technique, the ratio of line to background, in the case of the most sensitive tin line in particular, becomes very poor at the .002 percent level. For the lead line, the same condition results at .001 percent.

Another attempt to improve this situation has been described in the literature[7] by L. Larrieu of Morris P. Kirk & Sons. He utilized the last mentioned technique but changed the sensitiv-

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TABLE III

Element	Typical Analysis	Standard Deviation	Coefficient of Variation
Aluminum	4.05%	±.06%	1.5%
Copper	2.67	.03	1.1
Magnesium	.040	.0006	1.5
Iron	.035	.003	*9.
Cadmium	.0018	.00007	4.
Lead	.0020	.0001	5.
Tin	.0012	.00007	6.

*Due to segregation in the sample.

DIE CASTING permits as-cast sliding assembly

By T. L. PARKER*

IN the design of a lever type panel mounting switch, the electrical characteristics must be considered as of paramount importance. The mechanical and functional characteristics are tied onto the design as, of course, are the manufacturing costs, ease or difficulty of installation and servicing and the general appearance of the completed unit.

The type MCM lever switch shown in Figure 1 shows how the use of aluminum die castings can be instrumental in producing a switch which is mechanically good, performs its functional job safely and reliably, is relatively low in cost, and is so designed that both installation and servicing of the circuits are easy. This switch is a product of the General Control Co. of Boston, Mass. and the die castings in it are made by the Doehler-Jarvis Corp. of Toledo, Ohio.

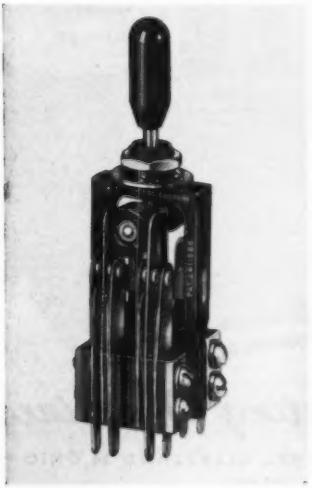
The two aluminum die castings used in this switch are shown in Figure 2. The frame was originally designed as a sand casting. This method of fabrication required that the casting be machined all over after it was received from the foundry. None of the holes were cored nor were the track slots in the sides cast in. Threads had to be cut after casting and general dimensional accuracy, while good for a sand casting, left much to be desider from the point of view of low cost manufacturing.

The contact block was machined from bar stock with all of the waste and high costs

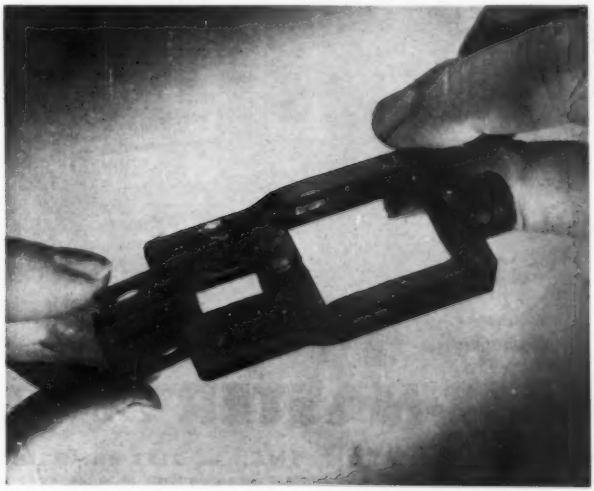
continued on next page

*Asst. Gen. Mgr. General Control Company.

1. DESIGNED around two die castings, this toggle switch will operate safely and reliably for extended periods of time.



2. THESE TWO DIE CASTINGS make possible the rapid installation, easy servicing, and low cost of the type MCM toggle switch. Improvement in design has been permitted by the change from sand castings.



attendant upon such an operation

When, in an attempt to lower manufacturing costs, a redesign was attempted; one of the manufacturing methods considered was die casting. A study of what could be done by the die caster soon developed a number of important advantages

1. The manufacturing cost could be lowered.
2. The appearance could be improved.
3. The functional characteristics could be improved.
4. Installed machine capacity could be released for other production.
5. Raised lettering could be incorporated in the casting process.
6. Inspection costs could be materially reduced.
7. Greater uniformity and hence greater interchangeability of component parts could be secured.

Considering the frame casting, it is presently being made so that only a minimum of machining is needed to ready it for finishing. The over-all length must be held to a dimensional tolerance of 0.005. This can readily be held by the foundry, but since normal die casting trim methods would not give the finish desired around the thread, a counter boring operation is necessary. For this reason, a loose tolerance is allowed the foundry and the final length adjusted when the bore is finished. Other slots, holes and critical dimensions on the frame are held to size by the caster.

Perhaps one of the more outstanding changes that redesign for die casting allowed was the change in shape of the web members. As a sand casting, these members were much heavier than at present at tapered uniformly from the thick side to the end. The sharp. section change that is now incorporated in the frame design was not possible when a sand casting was used. As a result, there was less room for spring leaves in the assembled switch and the slot into which the spring block fits had to be formed on a milling machine. With the present method of manufacture, no machine work at all is required on this part of the frame. A listing of all of the machining operations that are required on the frame shows that die casting has reduced machine time to a minimum. The needed operations are:

1. Trim to length and counterbore lever hole.
2. Drill hole for pivot pin.
3. Remove flash from track holes by broaching.

continued on page 114

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AMERICAN DIE CASTING INSTITUTE MEETS

DAVID LAINE GIVEN INDUSTRY'S HIGHEST AWARD BY ADCI

David Laine, secretary of The American Die Casting Institute for the past nine years, is the recipient of the Doehler Award for 1952, highest award of the die casting industry.

Presentation of the plaque and cash honorarium was a highlight of the annual banquet which was part of the annual meeting of the American Die Casting Institute September 17 and 18 in Chicago.

The annual Doehler Award for "outstanding achievement contributing to the advancement of the die casting industry" went to Mr. Laine for his energetic work on behalf of the entire industry.

He is now beginning his tenth year as secretary of the organization, having served during the period of the organization's growth from 30 members to a membership of 89 companies operating 100 contract die casting plants at the present time.

Mr. Laine has been instrumental in the conception and development of some of the Institute's major achievements of recent years, including the Certified Zinc Alloy Plan and the Safety Manual for the Die Casting Industry.

David Laine

The annual award, made possible by a fund set up in 1949 by Herman Doehler, chairman of the board of the Doehler-Jarvis Corp., carries with it a cash honorarium of $1000. The award has been made twice previously.

DIE CASTING RESEARCH FOUNDATION INTRODUCES TECHNICAL LEADERS

Dean Mathew A. Hunter of Renssalaer Polytechnic Institute and Prof. James L. Gregg of Cornell University, were introduced to the prospective members of the Die Casting Research Foundation at its meeting in Chicago on September 18, 1952.

Dean Hunter and Prof. Gregg, both of whom are scientists recognized for their work in the high temperature field, will serve as technical advisor and research co-ordinator respectively, to the Foundation.

The Die Casting Research Foundation will engage in and sponsor scientific research directed toward improvement in the technology of die castings.

The Foundation is supported by voluntary contributions from members of the industry. Altho in its formative stages, Directors of the Foundation were able to report substantial progress toward establishment of a sound operating program.

The Directors anticipate being able to announce completed program of the Foundation early in 1953, together with names of the research institutions where work will be undertaken.

V. H. Schnee Reports on Critical Situation in Metal Supply

An extensive report on the present and future supply of some of the rarer metals and alloying materials was the subject of the address given by Dr. Verne H. Schnee at the banquet which was a climax of ADCI sessions.

Dr. Schnee, as Executive Director of the Minerals and Metals Advisory Board of the National Academy of Sciences, is in close contact with the developing situation in this phase of production.

Dr. Schnee has had a long career in the field of metallurgy, serving with the U. S. Bureau of Mines, a professor at Cornell University, and a vice president at Cleveland Worm and Gear Co. From 1929 to 1934 he was with Rhodes, Inc., and from 1934 until he assumed his present assignment, he was supervisor of engineering at Battelle Memorial Institute in Columbus, Ohio.

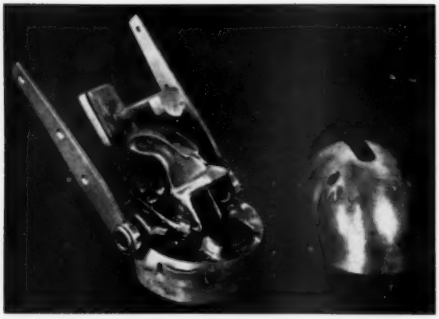
The two days of technical and business meetings heard several addresses and panel discussions on various phases of the die casting industry, and they also elected officers for the coming year.

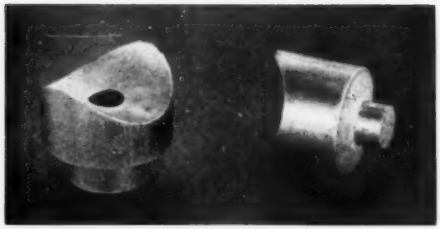
All officers were reelected for the coming year. They are: Austin T. Lillegren of Madison-Kipp Corp., president; G. M. Rollason of Aluminum Company of America, vice president; David Laine, secretary; W. J. Parker, treasurer.

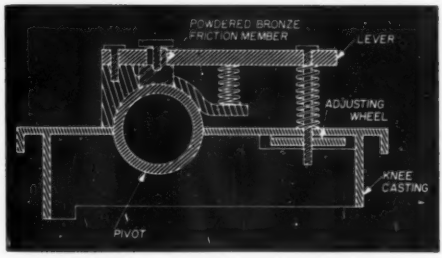
Directors for the coming year include: Eastern section, W. J. During of Precision Castings Co., Inc., G. M. Rollason, and T. J .Walker of Mt. Vernon Die Casting Co.

Central section, R. A. Luedtke of Schultz Die Casting Co., H. H. Weiss of Superior Die Casting Co., George Ralls of Pressure Castings, Inc., and A. J. Sanford

continued on page 79







FUNCTIONAL CHARACTERISTIC which gives superior control of motion in the artificial knee joint, Figure 1, above, depends upon the powdered bronze pressure plug shown in Figure 2, above right. The diagram, Figure 3, reveals construction of the adjustable friction joint.

Control of movement by POWDERED METAL friction joint

By L. H. BARGHAUSEN*

THE next time you see a man scratch the inside of his knee, through his pant leg, of course, don't be too sure that he has an itch —he may have a J. E. Hanger knee with climatic finger-tip control.

The manufacturers of artificial limbs are constantly attempting to improve their product so that the action will be as nearly normal and effortless as possible. In the older type of artificial leg, the knee was always a wooden structure with metal bushing and pivot pins. Some manufacturers then changed to a lightweight metal construction. In both of these, however, a severe drawback was the change in action with a change in ambient temperature. Adjusting screws were provided so that when the wearer went from a room at 75 F outside where the temperature might be 35 F, he could pull up his pant leg and go to work with a screw driver to loosen the action of the knee so that he could walk. Of course, when he went back inside and the knee warmed up and expanded, the action was too loose and the leg tended to fly about.

Since nothing could be done about the weather, the J. E. Hanger Co. of Pittsburgh decided to try and do something about correcting the method of adjusting the knee pivots. The result is that the control of the knee, is so easy and simple that it generally passes as a simple scratching operation and no need to raise the pant leg.

Utilizing a bewildering collection of metals and non-metals in its construction, the knee with its present simple method of adjustment was made possible only through the use of the small powdered metal part made by the National Molded Products Co. of St. Marys, Pa.

The knee, with the cap removed, and the powder bronze and graphite pressure plug

continued on page 54

*Inventor, J. E. Hanger Co., Pittsburgh, Pa.

Need Impact Strength?

TRIPLE SHOCK RESISTANCE

with

ALMAG 35

ALUMINUM ALLOY

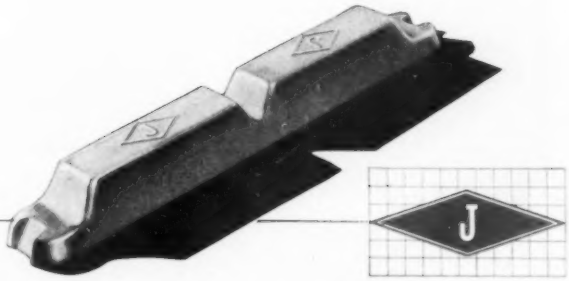
For the first time....all vital properties in one alloy, as-cast.

As-cast, with *no heat treatment* or age hardening, standard sand cast 90° V-notch test specimens of ALMAG 35 produce average Charpy Impact results of 10.47 foot pounds . . . nearly triple the impact resistance of heat treated alloys previously recommended.

Shock resistance is only one of ALMAG 35's standout qualities; it also possesses the highest, most stable combination of strength, ductility, corrosion resistance, and dimensional stability of any *as-cast* aluminum alloy.

Before you specify ANY alloy, request new Bulletin 350.

SPECIFICATIONS:
MIL-A-10935-6-7



U.S. Patent No. 2564044.

WILLIAM F. JOBBINS INCORPORATED

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POWDERED METAL JOINT
continued from page 52

which controls bearing pressure are shown in Figure 2. As can be seen from the illustration, the main casting has two split, adjustable bushing clamps. One of these is controlled by a set screw and about 25 percent of the necessary bearing pressure is permanently set by this screw. The other bushing, on the left side, has its bearing pressure and the pressure of the bronze plug, controlled by a lever and an adjusting screw and wheel. The action of this assembly can be seen more clearly in the schematic drawing of Figure 3.

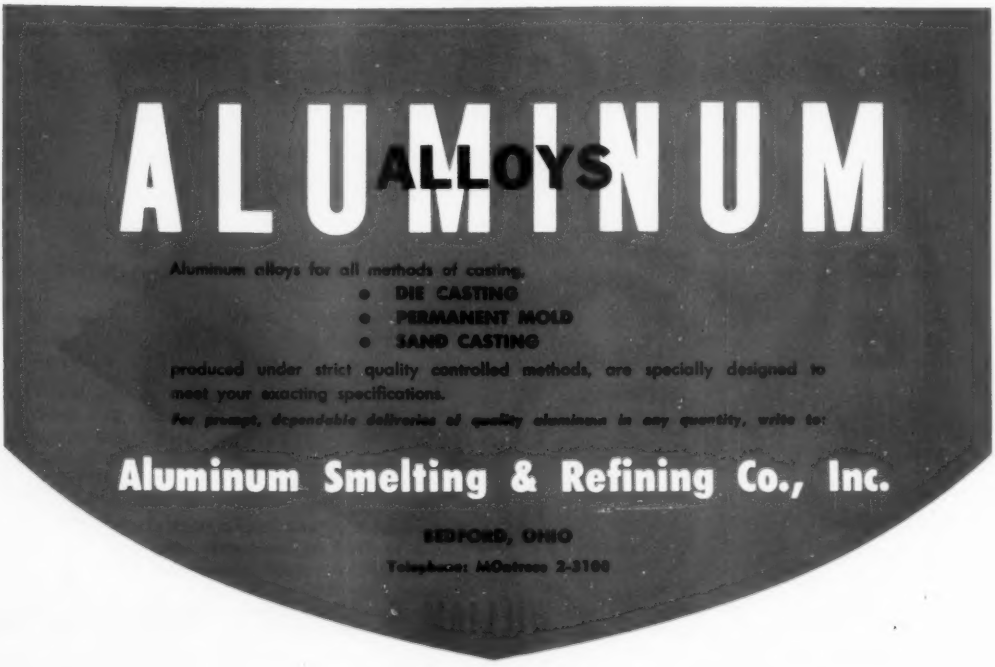
Referring now to Figure 3, it can be seen that by turning the adjusting wheel, the lever is raised and lowered and thereby increasing or decreasing the pressure on both the lip of the split bushing and on the pressure plug. If increased stiffness is desired, the wheel is turned so as to pull down on the lever. This puts some pressure on the split bushing through the spring, but the majority of the increased friction is secured by pressure of the bronze plug on the pivot pin.

Leverage is so arranged that a relatively few turns of the wheel will produce all of the pressure changes that are normally required.

Of all of the materials tried as pressure plugs, common failure was noise. When a solid metallic plug was used, the pivot invariably squeeked after a short period of use. Lubrication had to be automatic since the wearer could not be relied upon to do an oiling job either properly or often enough. Several non-metallic materials were tried, but when adequate oil impregnation was secured, the frictional characteristics were poor. The final solution, as has been indicated, came through the ability of powder metallurgy to combine bronze and graphite so that the graphite can properly lubricate the pivot and at the same time, not produce so slippery a joint that the desired stiffness could not be secured.

HOLD TOOLING CONFERENCE

The second annual Midwestern Tool Engineering conference sponsored by the Chicago Chapter of the American Society of Tool Engineers in cooperation with the Mechanical Engineering Department and Extension Division of the University of Illinois will be held November 8, at Urbana, Ill.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produced under strict quality controlled methods, are specially designed to meet your exacting specifications.
For prompt, dependable deliveries of quality aluminum in any quantity, write to:
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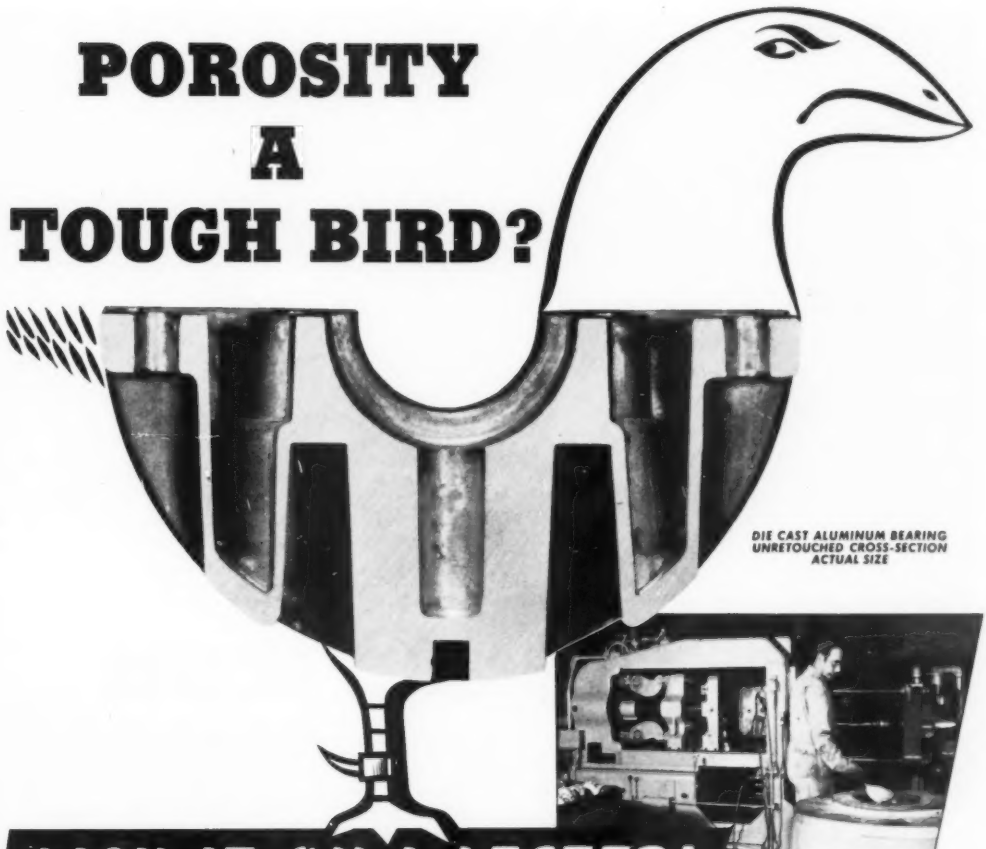
POROSITY A TOUGH BIRD?



DIE CAST ALUMINUM BEARING
UNRETOUCHED CROSS-SECTION
ACTUAL SIZE

LICK IT ON A LESTER!

HHP-3X-S in operation at McCulloch Motors, Los Angeles

"Prior to installing your Lester-Phoenix HHP-3X-S, it was considered that porosity in heavy sections was an unavoidable evil, inherent in the die casting process. Lester-Phoenix has virtually eliminated porosity in critical carburetor and bearing castings".

That's what Mr. Lee Witte, Superintendent in charge of the die casting department at McCulloch Motors Corporation in Los Angeles has to say about his new Lester-Phoenix equipment.

Our customers know how *really* good our machines are. They know that for day-in, day-out, trouble-free performance on the toughest jobs, they can depend on their Lesters. If you have a problem of porosity in aluminum die casting—or want top quality zinc production—write for the complete specifications on the machine with the capacity to fill your needs. And ask to be placed on the mailing list for the Lester-Phoenix house organ, "The Lester Press".

LESTER-PHOENIX DIE CASTING MACHINES

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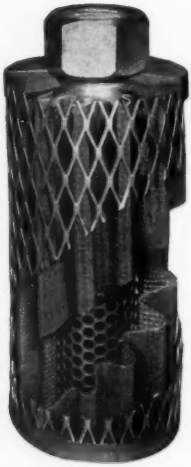
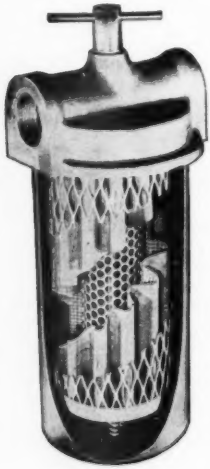
(Photo Courtesy Euclid Road Machinery Co., Cleveland, Ohio)

EUCLID 22 TON MODEL TD FEATURING HYDRAULIC BOOSTER STEERING. Marvel Synclinal Filters are installed in sump (indicated by arrow) as standard equipment to protect the entire hydraulic system against damage from the highly abrasive particles prevalent under the severe conditions to which "EUCS" are subjected.

MARVEL SYNCLINAL FILTERS



SUMP TYPE (Cutaway)



LINE TYPE (Cutaway)

Insure Dependable

PROTECTION and SERVICE

IN HYDRAULIC AND LOW PRESSURE SYSTEMS

More and more manufacturers and users of hydraulic machines and other equipment with low pressure, non-corrosive liquid systems are depending on Marvel Synclinal Filters are speeding production in a wide range of industries. They offer longer periods of operation between cleanings plus simplicity of design which enables ordinary workmen to quickly disassemble, clean and reassemble the filter on the spot. Turning a single handnut releases line type for cleaning without disturbing pipe connections.

★ WATER FILTERS

In response to the great demand, we have adapted both our sump and line types for use in all water filtering applications. No changes have been made in the basic synclinal design.

A SIZE FOR EVERY NEED

Sump and line type models available in capacities from 5 to 100 g.p.m. and in mesh sizes from 30 to 200.

Write for Complete Engineering Data
Specify Oil or Water

Meets J.I.C. Standards

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd. Chicago 6, Ill.

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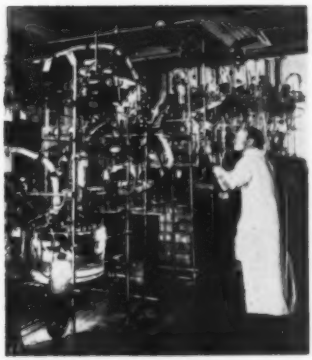
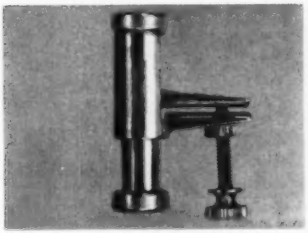
1. CORROSION RESISTANT die cast zinc lab fittings with nickel plating are used for this simple support rack. Ease of cleaning is a feature.



2. IF OVER-TIGHTENED, the clamps and fittings used for this complex unit resist breaking due to the yield of die cast zinc alloy.



3. BURETTE HOLDER of die cast zinc is stronger, better than old-style cast iron lab fittings.

4. VERSATILITY of die casting makes possible many designs not previously possible in cast iron.

Resistance to breaking featured in DIE CAST ZINC lab fittings

THe first Castaloy laboratory clamps and appliances appeared on the market in 1930 in answer to insistent demands for equipment of adequate strength and good corrosion resistance. *The older cast iron laboratory appliances left much to be desired. They broke easily when tightened enough to prevent slippage and the protective coating of paint failed quickly, allowing the corrosive fumes of the chemical laboratory to attack the unprotected cast iron.*

In hospital laboratories, bacteriological laboratories and similar institutions where corrosion was not as great a problem, the inability to sterilize the equipment, when necessary, was a serious drawback.

The new Castaloy appliances, manufactured by Fisher Scientific Co., are zinc base die castings plated with both copper and a heavy bright nickel. The resulting finish is smooth, chip-free, easily cleaned and sufficiently ductile to yield either elastically or plastically with the basis metal.

The use of die casting as a fabricating technique had a further advantage in allowing far greater flexibility of design than was possible with cast iron. As a result, many clamps and fixtures are now available that could never have been made by the older system.

The fight against corrosion has been carried as far as is economically possible. All springs are stainless steel and both wing nuts and french head screws are plated brass. Thumb screws are die cast aluminum.

Other than resistance to corrosion, the Castaloy fixtures have an additional advantage. Because both the aluminum wing screws and zinc base bodies are relatively soft as compared with the cast iron, they will yield either elastically or plastically so as to conform to slight irregularities on support members. This

continued on page 111

The Haller
OIL WELL PRINCIPLE

Now Being Applied To
POWDERED METAL PARTS LIKE THESE

Various types of bearings, bushings, gears, wear plates, machine gibs and other powdered metal parts now incorporate the Haller Oil Well feature.

Originally introduced in bearings, the forming of cavities or "pockets" in the center of powdered metal parts has proved to be a highly successful method of increasing oil content. In such parts, as oil or grease is impregnated into the sintered metal by static pressure, it fills the cavities as well as the pores in the sintered metal body itself. The result is a greatly increased lubricating quality which permits the parts to take heavier loads in their particular applications.

With the many new possibilities for adaptation of this design principle to a wide variety of parts, it can be to your advantage to investigate how it can be applied to your present or future products. The one limiting factor to be considered at the present time is that "oil well" parts are being produced in high volume on a contract basis only. We invite your inquiries.

Write for this bulletin describing our facilities and the scope of our powdered metal parts production.

MICHIGAN POWDERED METAL PRODUCTS COMPANY, INC.

466 CADY STREET • NORTHVILLE, MICH.

Subsidiary of
ALLIED PRODUCTS CORPORATION

For additional information Circle No. 45 on the Reader Service Card

ENOUGH ZINC FOR CURRENT & LONG-RANGE USE

Sufficient zinc supply to meet all future demand is foreseen in a recent statement issued by the American Zinc Institute, Inc., in a pamphlet entitled "More Facts About Zinc and What Is True 'Conservation'?"

The pamphlet lists seven facts which bear out the Institute's prediction, publicized in December 1951, that sufficient zinc would be available to meet all immediate and long-range needs.

At that time, the Institute stated that a balancing of supply and requirements was in sight and that zinc supplies for the foreseeable future would be adequate for all needs.

Facts set forth in the current bulletin to prove the accuracy of the prediction are:

1. The National Production Authority released zinc from allocation, delivery and use controls on May 15, 1952. Use restriction for consumers in the United Kingdom were removed on August 15.

2. Zinc is no longer classified as a critical and scarce material.

3. The government is making no regular purchases of zinc for the national stockpile.

4. Slab zinc production in the first seven months of 1952 exceeded 1951 production in the same period by 20,000 tons. Stocks of slab zinc at smelters on July 31 were 97,000 tons as compared to 22,000 tons on January 1, 1952. It is important to keep in mind that the greatly improved supply position is due only in part to the extended steel strike, stocks in producers' hands having shown a definite increase prior to the strike.

6. The current price of slab

continued on page 81

PMM

Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

A Section Devoted to Specialized Finishing of

Die Castings • Investment Castings • Powder Metal Parts
Permanent Mold Castings • Plaster Mold Castings

Cowles AM

A non-etching type aluminum cleaner for use in soak tank cleaning. It was specifically designed to remove drawing, stamping, spinning compounds, rolling oils, marking inks, crayon marks and shop dirt from common aluminum alloys prior to spot welding, anodizing or other finishing operations.

for better aluminum cleaning and deoxidizing

Cowles DO

A powdered acid type deoxidizer designed for efficient removal of the oxide film from aluminum prior to spot welding, anodizing or chromate finishing. It inhibits rapid reoxidation. DO solutions dissolve primary film rapidly, then reoxidize the metal surface slowly and uniformly with an air-stable oxide film without leaving smut residues.

Write for Technical Data Sheets on Cowles AM and DO Cleaners Prompt Shipments from Convenient Warehouse Stock

Cowles Technical Service Gladly Furnished Upon Request

COWLES CHEMICAL COMPANY
METAL CLEANER DEPARTMENT
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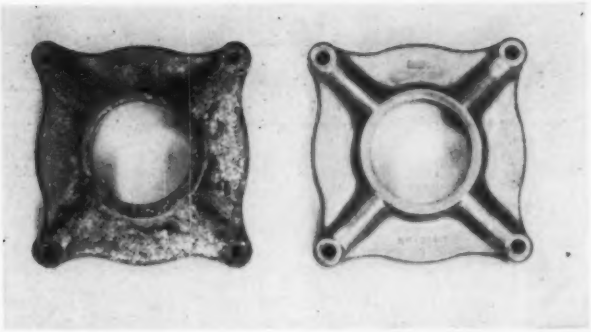
PART ONE



THESE DIE CASTINGS of aluminum alloy No. 13 were subjected to a 168-hr. salt spray test. Casting at left had no treatment; casting at right was given the new protective treatment.

Chromate surface treatment for PRECISION MOLDED ALUMINUM

By R. STRICKLEN*

WHILE the inherent corrosion resistance of all aluminum alloys is good in a rural atmosphere, the smoke and fumes of an industrial exposure and the salt mists of a marine exposure produce corrosion which varies with the alloy. **Table I** lists the aluminum alloys generally used in precision casting, indicating their nominal composition and their relative resistance to corrosive environments.

Some protection is required on all alloys if attack is to be prevented over long periods. Fairly good initial adhesion of paint films is obtained by etching or by treatment with unmodified solutions of phosphoric or chromic acids. However, moisture penetration of the organic film results in loss of adhesion in a relatively short time.

Anodic treatments have been used and while they give good paint adhesion they are expensive to apply. Furthermore, if abrasion exposes the underlying metal, all protection is lost on the abraded area. Oxide films, applied by immersion in hot alkaline solutions, crystalline metallic phosphate films, have all been used to some extent. Various disadvantages such as the need for ventilation and heating, critical control, and high material cost have been associated with these chemical treatments.

World War II established the merits of chromate surface conversion films on zinc and cadmium. Since then, Allied Research Products, Inc. has introduced Iridite No. 14, the first all chromate treatment for aluminum. Its acceptance under military specifications initiated wide application in place of anodizing and its simplicity of installation and operation have permitted general application

TABLE I

INHERENT CORROSION RESISTANCE OF ALUMINUM ALLOYS

ALLOY	EXPOSURE		NOMINAL COMPOSITION %		
	INDUSTRIAL	MARINE	CU	SI	MG
13	A	B		12.0	
43	A	B		5.0	
85	B	C	4.0	5.0	
122	B	C	10.0		0.2
A132	B	C	0.8	12.0	1.2
142	B	C	4.0		1.5
152	B	C	7.0	5.5	
195	B	C	4.5	0.8	
218	A	A			8.0
319	B	C	3.5	6.3	
355	B	C	1.3	5.0	0.6
360	A	B		9.5	0.5
380	B	C	3.5	8.5	

A — Good; B — Fair; C — Poor

*Development Engineer, Allied Research Products, Inc.

TABLE II
RESULTS OF SALT SPRAY TESTS

Alloy	Form	Hours to First Signs W/C	
		Min.	Max.
2S	Panel	250	500
3S	Panel	250	500
11S	Machined Bolts	150	300
17S	Machined Knobs	200	250
24S	Panel	200	300
52S	Panel	400	900
53S	Screen	600	1000
13	Die Cast Flange	100	175
43	Die Cast Kettle Spout	100	175
122	Permanent Mold Cast Test Bars	50	100
142	Permanent Mold Cast Test Bars	150	200
218	Die Cast Box	200	300
380	Die Cast Piston	100	175
75S	Panel	200	300
78S	Panel	200	300

as a protection and paint base for aluminum.

General properties

The Iridite film is an organic amorphous complex chromate which results from interaction of the solution and the aluminum surface. Neither the amount of aluminum removed, nor the thickness of the film produced is sufficient to affect dimensions of the work appreciably. The film is estimated to be .00001 or less in thickness.

The film is adherent and will not flake or peel in forming operations. While it is no harder than the surface of the untreated aluminum, exposure of the metal by abrasion is not a source of corrosion such as occurs when anodic films are broken. Soluble constituents in the film leach out and protect the abraded area. Another disadvantage of anodizing is embrittlement of thin sections of the metal. This does not occur with chromate treatment.

The color of the finish varies with the thickness of the film, as does also its corrosion resistance. Intensity of color and degree of corrosion resistance are further affected by the alloy of the metal. When the time of immersion is limited, up to approximately 30 seconds the film generated is not apparent to the eye, and thus, in effect, does not change the appearance of the aluminum surface.

Heavier films for greater corrosion protection can also be obtained without changing the appearance of the surface if the parts are buffed prior to applying Iridite. The only other means of providing a clear inorganic protective film has been anodic treatment.

In the case of die castings, a high silicon content is frequently necessary to obtain the desired physical properties. High silicon alloys will not take clear anodic films; thus, decorative finishing of the anodic type is impossible. In many such cases, clear films of Iridite No. 14 have been found applicable. Up to 56 hr of salt spray before first white corrosion has been reported on high silicon polished aluminum die castings.

Immersion in the Iridite solution for a longer time than that which produces the clear coatings (30 seconds) yields a heavier film that reflects a yellow color, This film becomes more evident as the immersion time increases from 30 seconds up to as long as 5 minutes. The surface of die cast alloys containing high copper and silicon generally takes on a lighter color for a given immersion time than low copper and silicon alloys. However ground or machined areas of such parts color about as intensely as wrought alloys, which normally show little variation in color when treated throughout the long immersion period ranges.

It has also been shown in the laboratories that the heavy film can be dyed various colors. However, it is anticipated that when the coloring technique is released to industry, it will be used substantially for parts identification rather than for decorative finishing, such as is

continued on page 64

TABLE III
RESISTANCE TO MILD ALKALIES

Test	pH	Die Castings Alloys 13 and 380		Sheet Stock — 3S Alloy		
		Iridite Yellow	No Treatment	Iridite Yellow	Iridite Clear	No treatment
Na_3PO_4	10	N.C.	G.C.	N.C.	G.T.	G.T.
Na_2CO_3	10	N.C.	G.C.	N.C.	S.T.	G.T.
Ivory Soap	10	N.C.	S.C.	N.C.	T.	S.P.P.
Fels Naptha	10	N.C.	S.C.	N.C.	N.C.	N.C.
Tide	10	N.C.	P.P.	N.C.	N.C.	N.C.
Fab	9.8	N.C.	P.P.	N.C.	N.C.	N.C.
Dreft	7.9	S.P.P.	G.P.P.	N.C.	N.C.	T.
Special (1)	11.7	N.C.	N.C.	N.C.	N.C.	N.C.
Special (2)	12.0	G.E.	G.E.	S.E.	S.E.	G.E.

Abbreviations above denote:

N.C. — No corrosion
G.C. — General corrosion
S.C. — Slight corrosion
S.T. — Slight tarnish
G.T. — General tarnish
T. — Tarnish
P.P. — Pin point
G.P.P. — General pin point
S.P.P. — Slight pin point
G.E. — General etching
S.E. — Slight etching

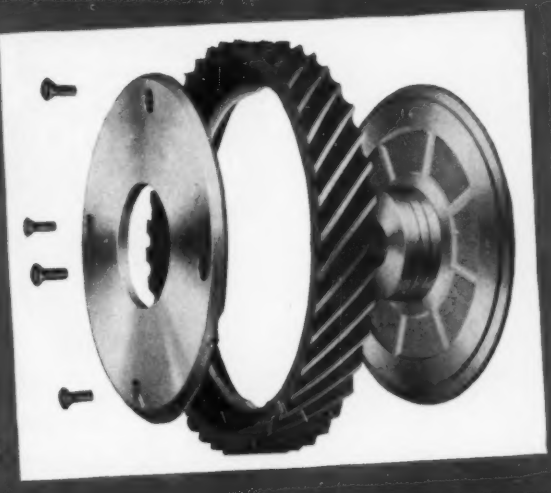
USERS SAY

"T-61"

UNIVERSAL HUB

CONTACT WHEEL

cuts Belt Grinding costs 3 ways



1 **Belts cut better, last longer—*Saves Material***

2 **Wheels cost less to renew—*Saves Money***

3 **Tire changes made quickly—*Saves Time***

REPORT NO. 3791

ACCOUNT:	Eastern manufacturer of stamping machines.
OPERATION:	Removing burrs from steel castings with backstand grinder using 14"x3" wheel, 148"x3" belt.
RESULTS:	Customer gets 300 finished pieces per belt with "T-61," compared with 105 pieces previously. Also eliminated one grinding wheel operation, further reducing costs.

Three-way belt grinding economy can be *yours* with the "T-61" Hub Wheel. It costs no more than solid type wheels—less in some sizes. One hub takes up to 144 different tires of various widths and hardness. New tires cost no more than re-covering old style wheels, save down-time and eliminate extra shipping costs. You install them quickly, without removing hub from spindle. Serrated rubber face causes *controlled* breakdown of belt bond, improving cutting action and lengthening belt life. Get the complete "T-61" story from your CARBORUNDUM distributor salesman—or write Dept. PM 82-80.

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Unique

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To get high production quickly in special machining operations is a problem die casters run into every day. Machining by hand on standard machine tools is too slow, too costly. Expensive, custom-built special purpose machines are often out of the question.

But if you have a tool engineer or designer with imagination, you can build many special purpose machines right in your own tool room, quickly and inexpensively.

The machine shown above was designed by S. J. Biello of Harvil New England Corporation and built in their own tool room. Two standard drill presses, and two Bellows electrically controlled Drill Press Feeds; a dial table and ejection device powered by two Bellows Air Motors, made a machine that was so fast it required two operators to keep pace with it.

Ingenuity and Bellows "Controlled-Air-Power" Devices help thousands of manufacturers get better, faster and safer production in second-operation die cast machining.

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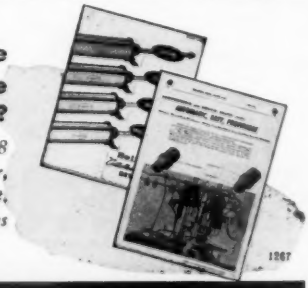
Write for Foto Facts File FF47-778 and for a copy of "Faster, Safer, Better Production." Free on request. Address Dept. DC1052, The Bellows Co., Akron 9, Ohio.



The Bellows Co.
ESTABLISHED 19
AKRON 9, OHIO

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obtainable with dyed sulfuric acid anodized surfaces.

Corrosion resistance

This chromate treatment has proved beneficial on all aluminum alloys and forms tested, including work hardening and heat treatable alloys in rolled, drawn, extruded, sand cast, permanent mold cast and die cast shapes.

The number of hours in salt spray to first signs of white corrosion varies in the same order as the inherent resistance of the alloy itself to salt spray attack. In general, the salt spray resistance is inversely proportional to the copper content of the alloy. High copper alloys, 5 to 10 percent copper, show first signs of breakdown in 50-to 200-hr. salt spray. Alloys with medium copper content, 3.5 to 5 percent withstand 200-to 300 hr. exposure. Alloys containing copper only as an impurity show first signs of white corrosion in 250 to 1000 hr. These figures in Table 2 are representative of production experience with the yellow coating.

Clear films can generally be classified as giving a salt spray resistance on the order of 25 percent of that obtainable with the yellow coating on any given alloy. However, this can be varied by the degree of mechanical or chemical polish on the metal surface before the application of Iridite. Both the yellow film and the clear treatment have been accepted in government specification on order MIL-C-5541, but the clear film is not recommended generally by the manufacturer for specification work where corrosion resistance is of prime importance.

Some work has been done on evaluating resistance to corrosion caused by various mild alkali, including various soaps and detergents. Table 3 illustrates results after 750-hr immersion in the solutions listed.

Some work has also been done to evaluate the contribution Iridite might make to help minimize the effects of galvanic corrosion. This study has proved it to be of some value and indicates measurable advantages. It will be interesting to note that in these salt spray tests, cadmium plus Iridite No. 1 and aluminum plus Iridite No. 14 afforded the best combination of treatments for the various metals brought into couples. In a corrosive medium, galvanic attack on the aluminum occurs at any junction with a cathodic metal such as copper, brass or steel.

A further gain in protection is realized when the difference in potential between the two metals is reduced by zinc or cadmium plating the cathodic metal, and by further protecting the plate with an appropriate Iridite film.

It appears that this type of film also affords effective corrosion protection to abraded areas. This was first noted on salt spray specimens which had been bent in a brake after treatment and before salt spray exposure. The surface was scratched by irregularities in the forming tools, and after 216 hours in salt spray no corrosion was apparent in the scratches.

This property was investigated further by salt spray exposure of Iridited panels along with anodized panels. After treatment, the panels were machine cut to a dept of 0.003 to 0.005 in. and varying in width up to ⅛ in. The so-called scratched areas on the chromic acid anodized panels corroded much more in salt spray. The explanation for this phenomenon is that Iridite possesses sufficient leaching qualities so that scratched areas are protected by the adjacent remaining film.

Paint base

Chromates provide their paint adhesion through an intimacy of contact, usually referred to as molecular adhesion. Initial adhesion is important

From finishing hardware . . .

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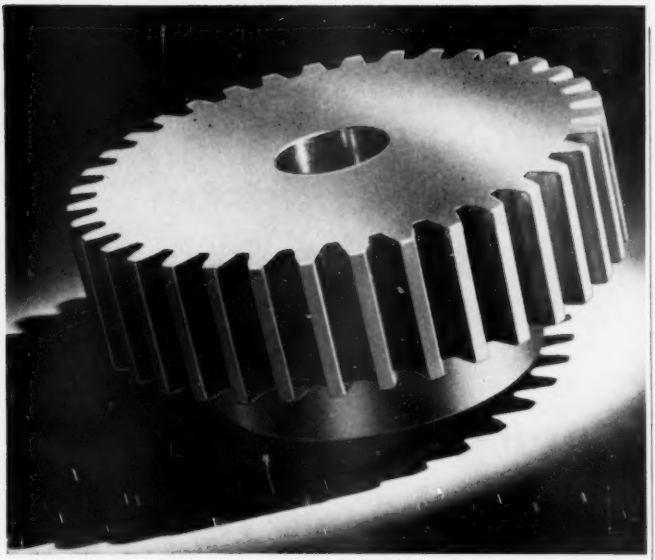

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TOUGHEST NATURAL CHIP! Use Regular Honite for close tolerance work or minimum removal of metal. No other barrel finishing abrasive—not even granite—retains its edge as long as Regular Honite.

WRITE TODAY for your free copy of "3M Barrel Finishing" . . . it's filled with helpful information for increased efficiency, lower costs. Address Minnesota Mining & Mfg. Co., Dept. PM102, St. Paul 6, Minnesota.

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Chromate Treatment

continued

only in that it causes the paint to adhere to the surface immediately upon application. Table 4 shows that Iridite No. 14 compares favorably with mechanical methods of adhesion in this respect.

Lasting paint adhesion is far more important. All paints have pores through which moisture will penetrate to the metallic surface. Upon reaching the aluminum surface, the moisture or corrosive atmosphere causes the formation of metallic soaps which raise the paint film. Iridite, however, provides a barrier against this moisture penetration. Even if the paint surface is scratched, corrosion adjacent to the scratch is retarded.

Electrical properties

Compared to anodic films, Iridite No. 14 films have an extremely low electrical resistance to direct current and to low and high frequency alternating current. This is of considerable advantage in electronics. Protection can be applied to chassis, shields, mounting brackets, wave guides, connector plugs, etc., without interfering with the electrical characteristics or ground connections. Table 5 shows some direct current measurements. Even though the resistance is several times that of clean aluminum, it is reported that 500,000 microhms is a satisfactory ground resistance and Iridite aluminum is well within this figure. Furthermore, the resistance of the Iridited aluminum will remain low while that of aluminum that is cleaned only will rise prohibitive values due to atmospheric oxidation.

In addition, the treatment offers a simplified means of eliminating RF interference by providing corrosion resistance directly on the aluminum surface; thus, the need for electroplating and subsequent treat-

continues on page 103

JUST HOW GOOD IS OAKITE'S NEW CONDITIONER FOR ZINC DIE CASTINGS?

IT HAS CUT OUR CLEANING REJECTS BY MORE THAN 90%

Here is what users are saying about Oakite Composition No. 95

ILLINOIS: We have found some very fine advantages in the use of Oakite Composition No. 95 . . . solution does not etch the die castings . . . original brightness carries through to brighter plated surfaces . . . free rinsing gives brighter plate with no under-surface films or streaks . . . No. 95 has turned out better work here with less rejects . . .

PENNSYLVANIA: We are having few failures due to cleaning in this line. Oakite Composition No. 95 is doing a swell job.

WISCONSIN: Castings retain their luster with good adhesion . . . no trouble . . . results very satisfactory.

ILLINOIS: Parts come clean with no attack on metal . . . plating is brighter and troubles fewer . . . this is the only good anodic cleaner we have found.

NEW JERSEY: Oakite Composition No. 95 is the best material we have used.

Yes, that statement was made by one of the manufacturers who cooperated in the field-testing of Oakite Composition No. 95.

He has found many advantages in this new anodic conditioner. Some of these advantages may be of value to you:

Brighter plating—Anodic conditioning with Oakite Composition No. 95 removes all films that might impair the brightness of the electroplate... no interfering residues... no under-surface shadows...

No anodic blackening—Castings do not lose their buffed-on brightness.

Fewer rejects—Oakite Composition No. 95 eliminates the major causes of peeling and blistering... consistent success in test-baking for 60 minutes at 300° F.

FREE For a copy of *"Good news about electrocleaning zinc-base die castings"*—describing the use of Oakite Composition No. 95—just drop us a note or mail the coupon.

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investigate zinc plate and Iridite (Bright) for a chrome-like decorative finish with more corrosion protection than conventional chrome plating . . . or Iridite (Metcote) as a treatment for copper that eliminates the need for buffing in the copper-chrome system; produces a sparkling bright finish!
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ASTE CHARTERS ITS 100TH CHAPTER

The 100th chapter of the American Society of Tool Engineers, this year celebrating its 20th anniversary, will be chartered in Memorial Hall in Athol, Mass. on the evening of October 14, 1952. An extensive program has been planned for the chartering affair which marks a milestone in the growth of the ASTE, the technical society of production experts whose membership as of August 15 of this year has swelled to 22,391 members.

The new chapter, which will be known as the North Central Massachusetts Chapter, will include members from industrial firms in the cities of Greenfield, Gardner, East Templeton, Orange, Winchendon and Athol, Mass.

The plants of the L. S. Starrett Company and Union Twist Drill Company will be toured by the more than 500 members and guests expected to attend the chartering ceremonies. A get acquainted gathering will be held in the Pequoig Hotel preceding the banque in Athol Memorial Hall.

NICKEL STRIKE PERMITTED UNDER CHROMIUM PLATE

Electroplaters are not permitted to use nickel in a "strike" of up to an average thickness of .00005 for a protective coating under electrodeposited chromium on articles where such use was heretofore prohibited, according to Schedule 1 of M-80 amended September 3.

This authorizes electroplaters to extend their business in non-industrial areas where defense work is slight by allowing the use of allocations (25 percent of base) on jobs such as replating or refinishing.

It recognizes the functional necessity for a very thin nickel coating as a base for chromium plating, thus placing the electroplating industry on the same footing with regard to nickel usage as in the vitreous enamel and silver plating fields.

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American Industry Prefers

ALMCO Supersheen

American Industry—both large and small companies—has overwhelmingly demonstrated its preference for ALMCO Supersheen Barrel Finishing Equipment and Materials.

The list of companies below represent but a few of the thousands of companies now using ALMCO Supersheen equipment for "A BETTER FINISH FASTER" *at lowest possible cost!*

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Chrysler Corp.
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Eclipse Pioneer Foundry Div. Bendix Aviation Corp.
Eclipse Machine Div. Bendix Aviation Corp.
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Ford Motor Co.
General Electric Co.
Guide Lamp Div. General Motors Corp.
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Leeds and Northrup Co.
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Vacuum metallizing produces bright metallic finish on DIE CASINGS

By R. W. BROWN*

1. TYPICAL OF DIE CAST parts which are being finished by vacuum metallizing are the array of parts above.

2. TUNGSTEN FILAMENT with attached loops of wire are shown. High-amperage current volatilizes the wire.

A NEW method of condensing a metallic vapor, under high vacuum, as a finish coat on a wide variety of die cast articles, is rapidly gaining prominence in the metal finishing field.

There are sound economic reasons for this. First, the vacuum coating method is capable of providing a high gloss finish while at the same time greatly reducing or entirely eliminating expensive hand buffing operations which are necessary when other finishing methods are used.

Next, the vacuum coating technique offers several other advantages. It is clean, involving no messy chemicals or solutions, and developing no objectionable fumes. It is simple, requiring relatively low-skilled labor, and it is speedy, with high production per worker possible. Furthermore, it uses only a minimum of material, and thus is not particularly subject to restrictions on the consumption of critical metals. Ordinary and plentiful 2S aluminum is the usually preferred metal for the coating, although copper, zinc, silver, gold, and even stainless steel have been applied successfully by the vacuum vaporization technique.

Method and equipment for vacuum metallizing

The vacuum coating method is essentially a three-step process, beginning with a die casting or other article as the base material that is to receive the coating.

The first of the finish steps is the application of a coat of lacquer, which usually is put on by dipping. The reason for the lacquer undercoat is to fill minor surface irregular-

*Distillation Products Industries, Eastman Kodak Company.

ities, and to provide a smooth, glossy surface for the metallic coating. This lacquer coat must be baked on to insure the complete removal of volatiles which otherwise might subsequently evaporate and thus impair the quality of the finish.

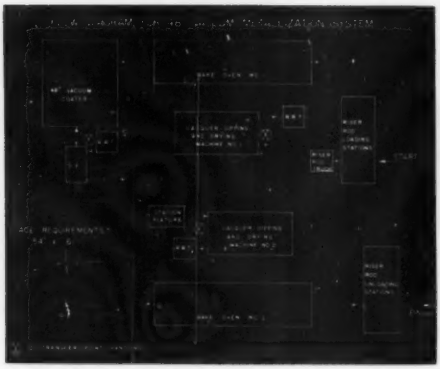
The second step is the condensation, on the article to be coated, of a thin film of coating metal. This must be done under a high vacuum of the order of about ½ micron — approximately 1/1,500,000 of atmospheric pressure. Modern oil diffusion vacuum pumps are capable of drawing a relatively large enclosure down to that degree of vacuum quickly and efficiently.

The vacuum unit in most common use for this process is a chamber 48 inches in diameter, and slightly more than that in length, fitted with three, or sometimes four, vacuum pumps of bot hmechanical and oil-diffusion types, so arranged and connected as to give most effective results. Properly engineered equipment is capable of pumping the required vacuum in the 48- inch chamber in less than 20 minutes.

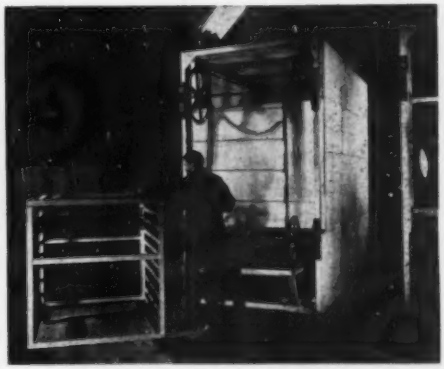
In the central part of this vacuum chamber is an arrangement of tungsten filaments, their number, position and spacing depending on the size and shape of the articles to be coated. In preparation for the actual coating operation small loops, or "hairpins," of the coating metal are hung on the filaments.

When the castings have been properly prepared — that is, after they have been trimmed, and the undercoat of lacquer has been applied and baked on — they are arranged on jigs about the outer portion of the chamber. Then the unit is closed, and the vacuum pumps turned on. As soon as the pressure in the chamber has been reduced to the ½ micron that is necessary for the process a high-amperage current is applied to the filaments. This quickly melts the loops of the coating metal, and within a few seconds the metal vaporizes completely.

Since there are almost no air molecules remaining in the enclosure to obstruct them, the vaporized metal particles disseminate outward in straight lines from the molten source, and condense in a thin but uniform film on the first cool surface with which they come in contact. The articles to be coated are arranged in such a way as to provide the first such opportunity for the condensation of the vapor.



3. FLOW DIAGRAM for a 48 in. vacuum metallization system reveals the successive steps in the processing.



4. LACQUER DIPPING and drying is accomplished by means of this automatic machine for both base and over-coat.

If the objects are to be given a complete all-around coating they are mounted on rotating jigs which turn them during the heating portion of the cycle, so that the metallic vapor condenses uniformly on all sides. When only one face of the object is to be coated, as in the case of a lamp reflector, for instance, the jigs can be stationary.

The third and final step in the vacuum coating process is the application of another coat of lacquer. This serves to give the articles a high gloss finish, and to protect the thin metal coating, which is only a few millionths of an inch thick, against wear. This outer coat of lacquer also can serve another important purpose. It may be dyed virtually any color of the rainbow, so that aluminum-coated articles can be given the appearance of gold, or copper or in fact, may be

continued next page

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AND CHIPS ARE MADE TO GIVE YOU THE PROPER FINISH ECONOMICALLY

There are other brands of materials that resemble Roto-Finish chips and compounds . . . but only Roto-Finish chips and compounds give you the *extra advantage* of continuous research by the company who originated the Roto-Finish processes. Roto-Finish chips and compounds are carefully manufactured so *you* obtain the best results on *your specific job*. To obtain the best results at the lowest cost . . . insist on ROTO-FINISH chips and compounds.

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SAVES MAN HOURS AND MONEY by eliminating hand finishing.
GIVES ABSOLUTE UNIFORMITY...in any quantity.
MAINTAINS PRECISION TOLERANCES.
CUTS FINISHING costs as much as 80%.
LOWERS INITIAL and MAINTENANCE costs.

ROTO-FINISH COST-FREE ENGINEERING SERVICE GUARANTEES RESULTS

Put the experience and facilities of Roto-Finish to work for you on your special finishing problems.

Send a few unfinished parts to us . . . plus a finished part as a guide. We guarantee that you will get the same results in your plant that we produce in our laboratory. There's no obligation.

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tinted to match or harmonize with any housewife's color scheme.

Decorative uses, including such articles as toys, costume jewelry, sports trophies, and ornaments of a great many kinds, constitute the bulk of the items in which vacuum coating of metals now is being applied. However, strictly utilitaran objects, such as drawer handles and other household hardware, lamp reflectors, appliance parts, and other similar items also have been added to the list recently.

5. LOADED RISER rod shows spring clip arrangement for holding castings.

The development of polymerizing lacquers which harden into a tough durable coating that is capable of protecting the metal film against considerable wear has been one of the factors that has made it possible to use the process on items that are exposed to mildly abrasive forces.

The preference for aluminum as the coating metal is supported by several good reasons. First is its high reflectivity, which gives a glossy polish that is unequaled by other coating metals. It was aluminum that was selected for coating the mirror of the big 200-inch telescope at Palomar, where the requirements for reflectivity are of the highest order. And that coating, incidentally, was applied, and is

continued on page 76

PMM NEW PRODUCTS

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

LUBRICANT FOR COLD CHAMBER DIE CASTING MACHINES

Plunger Slick

G. W. Smith & Sons, Inc.

SPECIAL FEATURES: New lubricant for cold chamber die casting machines is said to eliminate galling and sticking of the plunger. Does not run off at high temperatures.

Plunger and cylinder are completely protected against the corrosive action of molten aluminum. Company reports that from 5 to 7 more casting shots may be made between applications of Plunger Slick than with conventional types of lubes.

Available in 1, 5 and 55 gallon drums.

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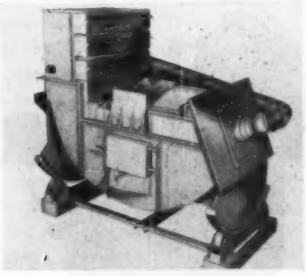
REVERBERATORY FURNACE FOR FERROUS & NON-FERROUS MELTING

Eclipse Fuel Engineering Co.



SPECIAL FEATURES: Continuous-charge, continuous-pour melting of ferrous & non-ferrous metals suited to die casting and other precision types of metal casting operations. Hot metal always available for pouring, combustion normally wasted is used for melting or preheating cold metal in hopper.

Non-crucible, direct-fired reverberatory furnace reported to give quality castings at less time and cost. Efficient for large or small heats.

SPECIFICATIONS: Fired by oil or gas fuels. Standard models with bath capacities ranging from 300 to 4400 lbs. Near-perfect combustion reported. Unique hopper design has restricted opening at bottom to prevent cold metal from contacting melted metal. Melt of from 1200 to 1500 lbs. steel scrap is tapped within 30 minutes depending on size of gates & risers. Fuel consumption 55-60 gal. hr.

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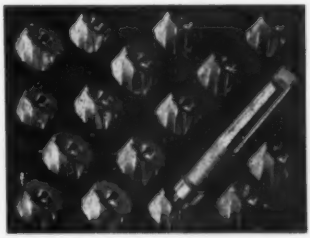
---

REAMERS WITH INTERCHANGEABLE HEADS

The Tomkins-Johnson Co.

SPECIAL FEATURES: One shank quickly & easily interchanged with wide range of heads. Replacement costs for reamers cut in half. Lower initial cost permits larger inventory of reamers.



SPECIFICATIONS: Available spiral or straight flute. Head has tapered hole for concentricity, snug fit. Reamer heads can be changed by machinist when working with different metals. Reamer designed to operate free from binding or sticking.

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---

ELECTRIC-AIR TAPPING & DRILLING MACHINE

Ettco Tool Co.

SPECIAL FEATURES: Patented electrically controlled 4-way air valve with built-in up & down speed control built specially for the machine. Uses either single or multiple head with provisions for multiple work holders.

SPECIFICATIONS: Can be run on continuous, automatic cycle or single stroke controlled by foot or hand. Indexing fixtures or work holders can be built. Built-in oil pump gives sufficient oil supply at all times.

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continued next page

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PRESSURE CASTINGS
Economically

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Meets All Contract Specifications

If your contract calls for casting impregnation, get the facts on this MOGULLIZER packaged plant which utilizes both pressure and vacuum stages.

Write today for free literature and recommendations for your casting salvage problems.

NOTE: There are job shops in certain areas who can take care of your contract work. A few territories are still open for job shop installation. Write for set-up plan today.

METALLIZING CO. OF AMERICA

Dept. [illegible] Lawrence Ave., Chicago 30, Ill., Telephone: NAvarre 3-3710

New Products continued

SPECIAL ELECTROCLEANER FOR ZINC DIE CASTINGS

Oakite Composition No. 95
Oakite Products, Inc.

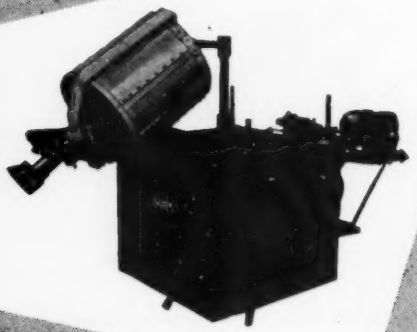
SPECIAL FEATURES: Primarily designed as electrolytic conditioner for zinc base die castings in preparation for plating. Gives fewer rejects, brighter plating, no blackening during anodic cleaning.

SPECIFICATIONS: Composition No. 95 anodic conditioning removes surface films, disturbed metal & soil. It avoids hydrogen gas formations that raise blisters & peeling. Reports show no blistering of plate after 1 hr. baking at 300F. Free rinsing. Controlled uniform etch eliminates under-surface shadows. The Oakite Composition No. 95 rinses so freely that even with dry-down time as long as one minute, as in automatic plating, no residue films appear on the castings. Complete operating procedures have been established and can be obtained.

For additional information Circle No. 200 on Reader Service Card

THE **OLS** FOR BETTER PLATING

Before you invest in barrel plating equipment, check the features of the Daniels OLS Plating Barrels. Forty years of experience in manufacturing barrel plating equipment have led to the new Daniels OLS which can only be fully appreciated by thoroughly reviewing the facts as illustrated in our new catalog. *Write for your copy today!*



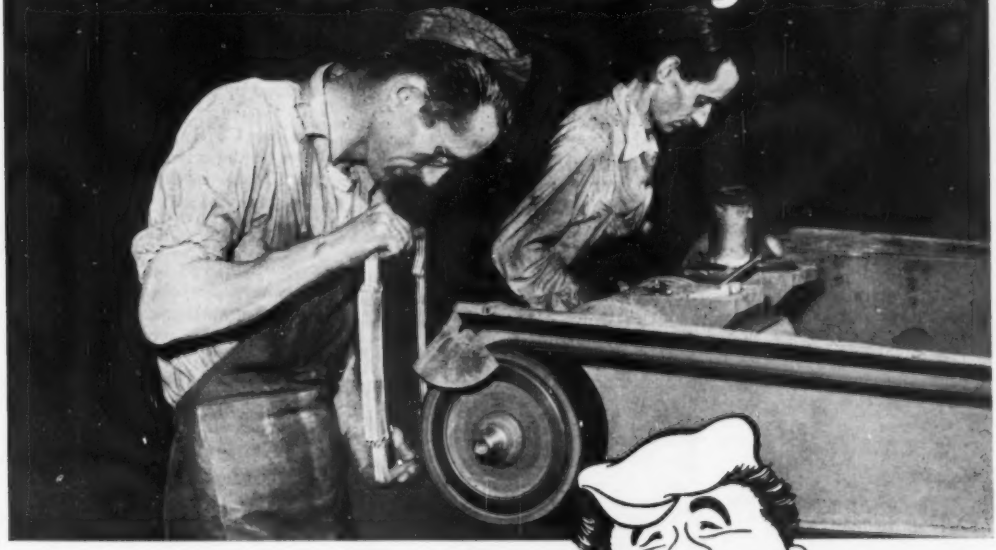
#4 OLS in unloading position

DANIELS PLATING BARREL & SUPPLY CO.
MANUFACTURERS and DISTRIBUTORS
Electroplating and Polishing Equipment and Supplies
129 Oliver Street, Newark 5, N. J. • Tel. MArket 3-7450

DANIELS

For additional information Circle No. 71 on the Reader Service Card

Here's the secret of Polishing Profits!



POLISHER PETE HAS SWITCHED TO MODERN BEHR-MANNING ABRASIVE BELTS . . .

No more wild grain marks, excessive rejects, snail's-pace production. Whether it's a pre-plating finish, deep contour polishing or any other critical or tough polishing job, the right BEHR-MANNING abrasive belt and the right contact wheel make a combination that wins hands down, cuts out the headaches, and boosts the profits to a new high.

Polisher Pete has the answers. Read his booklet (use coupon at right). And for expert co-operation on your specific polishing problem, call in the BEHR-MANNING Field Engineer. No obligation.

For export: Norton Behr-Manning Overseas Inc., New Rochelle, N. Y., U. S. A. In Canada: Behr-Manning (Canada) Ltd., Brantford.

BEHR-MANNING CORP., Troy, N. Y., Dept. PR-10

Please send me your new booklet, "How Polisher Pete Put Economy in Polishing."

Name_____

Street_____

City_____ Zone___ State_____

BEHR-MANNING CORPORATION
division of NORTON Company

▲COATED ABRASIVES ▲SHARPENING STONES ▲PRESSURE-SENSITIVE TAPES

For additional information Circle No. 33 on the Reader Service Card

VACUUM METALLIZING
continued from page 72

periodically renewed, by the vacuum vaporization method.

Aluminum also has physical properties which adapt it well to the process, for, when molten under vacuum it wets the tungsten filament thus providing a large surface, uniformly heated, from which the metal vaporizes.

Although this unfamiliar process may sound cumbersome and slow, because of the vacuum pumping involved in it, actually production rates can be very high. The 48-inch chamber mentioned above, for instance, has a capacity of approximately 2,500 pieces, about 2 inches in diameter, in a single load. On the basis of 20-minute cycles, that yields a production rate of 7,500 per hour.

TUNGSTEN MINING RISES

Domestic mining of tungsten concentrates exceeded consumption in May and June 1952, according to the Bureau of Mines. Only other periods in recent history when this occurred were in the third quarter of 1949 and first quarter of 1946.

ADHERES to almost any metal
INVISIBLE on all of them

DULAC Clear Universal Lacquer #462—a *single* water-white lacquer with remarkable adhesion to practically *all* metals. Finishing shop after finishing shop* reports that this M & W lacquer can be applied with *equal* success to just about any metal—and that it's invisible when applied. AND . . . tests conducted by an unbiased laboratory show that DULAC #462 withstands salt spray and weatherometer tests for longer periods than ordinary lacquers.

DULAC #462 forms a tough, lasting protective film that resists heat, cold, weather, stain, perspiration. It cuts *inventories*, because one lacquer handles so many metals. It cuts *production time*, because it dries out of dust in 5 to 10 minutes . . . hard in an hour. Applied by spray or dip.

*Names on request

PIONEERS IN PROTECTION — 74th YEAR

For complete information, write for Technical Data Bulletin #110.

MAAS & WALDSTEIN CO. 438 RIVERSIDE AVE. NEWARK 4, N. J.

Midwest Div.: 1658 Carroll Ave., Chicago 12, Ill. • Pacific Coast Div.: Smith-Davis Co., 10751 Venice Blvd., Los Angeles 34, Cal.

MANUFACTURERS OF INDUSTRIAL FINISHES

For additional information Circle No. 72 on the Reader Service Card

NEW ALUMINUM ALLOY TAKES BRIGHT FINISH; COMPETES WITH CHROME

An aluminum alloy that will take an unusually brilliant Alumilite finish has been developed by Aluminum Company of America.

Alcoa C57S, as the alloy has been designated, holds great promise in the field of automobile trim, Alcoa's engneers believe. With an Alumilite coating it could be used as an attractive, economical and long-lasting replacement for chormium plating and stainless steel.

Alcoa C57S would bring a new versatility to automobile trim. Besides taking a clear Alumilite finish of high brilliance, this alloy offers the added attraction of colored Alumilite finishes in many shades.

Although this is the first public announcement of Alcoa C57S, it has been used extensively in the field of giftware and refrigerator trim. From experience in these applications, a good working knowledge of the alloy has been developed.

Alumilite-treated C57S approaches high-purity aluminum in the transparency, metallic luster, and sheen of its finish, while affording substantially higher mechanical properties. It has excellent forming characteristics.

NICKEL SUPPLY TO CONTINUE TIGHT

The supply situation for nickel is unchanged and any relaxation of controls on nickel definitely is not likely, at least during the next year, members of the Stainless Steel Industry Advisory Committee have been told by officials of the National Production Authority, Department of Commerce.

Any apparent improvement that may exist in the supply of nickel, NPA said, is the result only of temporary adjustments and changes in certain types of demands and programs.

PMM USEFUL LITERATURE

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

PROCESSES

Sliding & Rotating Parts Difficult to Lubricate No. 144
Mechanical parts produced from carbon to solve problems caused by sliding or rotating parts that are difficult to lubricate are the subject of Bulletin No. 52 from Pure Carbon Co. Purebon rings, bearings, vanes, valve seats, etc., are molded to finished size.

Non-Ferrous Castings (Sand, Permanent Mold, Centrifugal): No. 145
A folder from Hampden Brass and Aluminum Co. shows many non-ferrous castings produced by the company by sand, permanent mold and centrifugal casting methods. Aircraft locomotive, household appliance, portable tool and other components are included.

Six Applications of Zinc Die Castings: No. 146
Volume 20, No. 2, of The Alloy Pot published by The New Jersey Zinc Company contains six interesting case histories of products using zinc die castings. Featured is a double page of hardware specialties.

Using Investment Castings: No. 147
In a folder entitled, "There Is One Right Way to Form These Parts," Hitchiner Manufacturing Co. has produced a report on the investment casting process and ways to use it for components.

Consulting Engineering Service: No. 148
From Sam Tour & Co., Inc., has been received a brochure introducing the firm's service as engineering consultants. Consultation and development work, new materials, legal testimony based on investigation, nondestructive testing and process development are among fields covered.

MATERIALS & EQUIPMENT

Micrometer-Stop Countersink: No. 155
A new type of micrometer-stop countersink with non-rotating head and positive-lock adjustment are announced by Severance Tool Company in a folder. Adjustments in .001 increments permits precision countersinking.

Aluminum in the Automotive Industry: No. 156
In a graphic presentation of the subject, Reynolds Metals Company has released a folder, "Here's What the Automotive Industry Is Doing with Aluminum." A diagram with 3-color keys indicates present, imminent and probable applications of aluminum on cars.

Report on the Zinc Supply Situation: No. 157
A brochure compiled by The American Zinc Institute lists seven facts which demonstrate that there is ample supply of zinc for all current and long-range needs. It also comments on false "conservation" of zinc.

Die Casting Die Lubricant: No. 158
A small piece of literature from Gredag Inc., a unit of Acheson Colloids Corp., describes Gredag PL8, a die casting grease for lubrication of cores, plungers, slides, etc.

Tool and Die Salvage Manual: No. 159
A 64-page, profusely illustrated manual from Eutectic Welding Alloys Corp. is devoted to the subject of Tool and Die Salvage. This is one of the company's series of "How-to-Weld-It Better" manuals, and contains more than 100 photos.

Data Sheet on Powdered Metal Press: No. 160
A data sheet from Arthur Colton Co. gives details and specs on the new Colton-Haller hydraulic presses for powdered metals and other compounds. Two models have 100-ton and 125-ton capacities.

Hydraulic Fluid Safe When Sprayed on Molten Metal: No. 161
Information on Ucon Hydrolubes, hydraulic fluids reported to be safe for use around sources of ignition and heat, is offered by Carbide and Carbon Chemicals Co. The company states that the water-soluble fluid does not cause fire, even when sprayed on molten metal.

Aluminum Base Alloys with Unusual Properties: No. 162
A series of aluminum base alloys in which the principal alloying constituent is the ternary compound $Al_2Mg_3Zn_3$ is introduced in a folder from Apex Smelting Co. Called Ternalloys, they are available in 4 compositions having unusual properties predicated of the casting requirements and foundry process: sand, permanent mold, die casting or plaster mold casting.

Catalog of Indicating, Controlling, Recording Units: No. 163
A molten metal thermocouple for ferrous metals is one of many items included in the new 42-page data book and catalog of thermocouples, radiation detectors and resistance bulbs issued by Wheelco Instruments Div., Barber-Colman Co.

Granite Surface Plates: No. 164
Features and advantages of granite surface plates for precision measuring and gaging operations are listed and discussed in a data sheet recently published by The DoALL Company.

Metal Processing Chemical: No. 165
A technical data sheet from American Cyanamid Company describes Aeroheat 1200-R, a metal processing chemical. The company identifies it as a highly concentrated rectifier for use with neutral type salt baths under extreme operating conditions.

FINISHING

Magnesium Finishing Manual: No. 170
A new revision of its 128-page manual describing finishing systems for magnesium products has been made available by the Magnesium Dept., Dow Chemical Co. It describes in detail surface stability and surface treatment including cleaning, mechanical finishing, chemical treatments, electroplating, painting and assembly protection for magnesium die, sand and permanent mold castings as well as sheet, plate and extrusions.

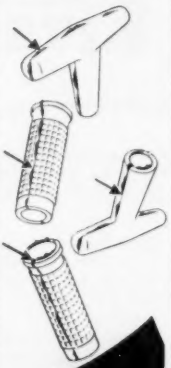
Heavier, More Uniform Etch on Aluminum: No. 171
A new material Oakitie Composition No. 60, designed to produce a heavier, more uniform etch on aluminum, is the subject of a data sheet from Oakite Products. It is reported to give a velvet-like appearance on the surface.

Metal Fluoborate Solutions for Electroplating: No. 172
An informative and technical booklet published by General Chemical Div. of Allied Chemical & Dye Corp. outlines how metal fluoborate solutions can be used for economical plating. Lead, tin, iron, copper, nickel, cadmium and indium are plated from fluoborate baths.

continued next page

SAND-O-FLEX beats...

belts, buffs, barrels, backstands and blasting for deburring and finishing aluminum tool handles!



Note how brushes force the abrasive cloth into the corner thereby eliminating tedious hand methods.

THESE cast-aluminum tool handles used on torque wrenches, manufactured by J-O Manufacturing Company, South Gate, California, come out of the mold with a sharp flash and seam around the entire part. Some of the burrs are inaccessible and an extended search was made for a flexible tool that would get in and around the contours without "flatting" or marring the handles. Sand-O-Flex is the only tool that gets down in and around all surfaces. It not only removes the burrs and seam in one pass, but prepares the surface for anodizing.

Sand-O-Flex does so many jobs so much better. If you have a finishing problem on contoured parts, you need Sand-O-Flex. Simply fasten a Sand-O-Flex to any rotating shaft (motor, lathe electric drill, etc.)—no special equipment necessary. As it spins, brushes cushion the abrasive cloth and mold it to intricate work shapes. A central magazine holds the abrasive cartridge and as it wears, it is fed out by hand in a matter of seconds. Abrasives are furnished in many grits for a wide variety of finishes on all types of metals. With heavier grit fillers, Sand-O-Flex is also ideal for removing tool marks, rough-grind marks, and deburring complex steel surfaces. Four models—from small portable applications to heavy-duty production line uses. For free catalog and prices, write to

MERIT PRODUCTS, INC.

4023 Irving Place, Culver City, California

For additional information Circle No. 73 on the Reader Service Card

USEFUL LITERATURE continued

Chromate Type Zinc Conversion Coatings: **No. 173**

Unichrome Dip and Anozinc Processes for producing corrosion-resisting, chromate conversion coatings on zinc die castings are the subjects of a new folder from United Chromium, Inc.

Automatic Barrel Plating & Processing Machine: **No. 174**

A new bulletin on the Stevens automatic barrel plating and processing machine is available from Frederic B. Stevens, Inc. The automatic barrel machine is pictured in use for phosphate coating as well as plating and features completely automatic loading and unloading.

Locknuts: **No. 175**

A 24-page data book on the subject of Locknuts has been issued by the Industrial Fasteners Institute. Types of locknuts, principles of operation, and names of manufacturers of each type, are included, along with pictures and drawings.

Welding or Soldering Zinc or Aluminum: **No. 176**

A piece of descriptive literature from Chemalloy Associates gives information on Chemalloy welding and soldering metal for use with any aluminum or zinc base metal or alloy.

Complete Tool Catalog: **No. 177**

In a 60-page, elaborately set-up catalog, Carboloy Dept. of General Electric presents a complete line of tools of Carboloy cemented carbide. A technical data section, and a 4-color photographic section are included.

Cut Costs with MEAD MIDGET AIR CLAMPS

Horizontal and vertical!

Pneumatic Cylinders

Both models deliver 80 lbs. pressure on a line pressure of 100 lbs. They'll save countless man-hours in assembly operations involving welding, riveting, bolting, etc. Advantages over mechanical clamps: 1, Any number can be operated by single master valves. 2, Easily installed in cramped corners. 3, Equal ram pressure at any stroke point. Send for new Mead AIR POWER Catalog, describing our line of Air Clamps, Air Vises, Air Presses, Work Feeders, Valves, Controls, etc.

MEAD SPECIALTIES COMPANY

4114 No. Knox Ave. Dept. DC-102 Chicago 41, Ill.

For additional information Circle No. 101 on the Reader Service Card

Coated Abrasive for Dry Belt Grinding: No. 178

A new type of coated abrasive is presented in Booklet No. 2 from The Carborundum Company on its resin industrial cloth. Manufacture and application of this coated abrasive for dry belt grinding are reported, along with data on obtainable results

Application of Diamond Abrasives: No. 179

Abrasive Div. of Elgin National Watch Company has made available a new 8-page booklet on the efficient application of diamond abrasives. Particular emphasis is given to die finishing.

Jet Black Finish for Iron & Steel: No. 180

A new jet black finish for iron and steel, reported to have 10 times the corrosion resistance of conventional blacks, has been introduced in a technical bulletin from Parker Rust Proof Co.

Rectifiers for Plating, Anodizing: No. 181

Loose-leaf type catalog sheets on Richardson-Allen selenium rectifiers for electroplating and anodizing has been offered by Wesley Block & Co.

Portable Lucite Plating Barrel: No. 182

A new portable lucite plating barrel manufactured by George A. Stutz Company is the subject of a folder recently received.

Cleaning & Phosphate Coating Compound: No. 183

A leaflet describing Detrex 79, a compound used for cleaning and imparting a fine-grained phosphate coating to steel parts for paint bond, has been issued by Detrex Corp.

DIE CASTING INSTITUTE

continued from page 51

of Cleveland Hardware & Forging Co., ex-officio member.

Midwest section, A. T. Lillegren, C. G. Adams of Twin City Die Casting Co., and H. F. Schroeder of Milwaukee Die Casting Co.

Pacific section, R. R. Dreibus of Harvill Die Casting Co., A. W. Simpson III of Western Die Casting Co., and J. M. Davis of Union Die Casting Co.

Directors at large, F. J Kcegler of Doehler Jarvis Corp., L. G. Vanderhoof of Stewart Die Casting Div., and E. Anderson of Globe-Union.

732 Iowa Ave., Saginaw, Michigan

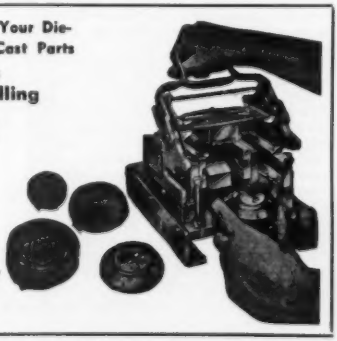
If you don't have a SEVERANCE "ALL STAR" Catalog, ask for one today!

ENAMEL FILL Your Die-Cast Parts

In Color With Lettering and Design

5 TIMES FASTER Than Hand Filling

The Acroprinter illustrated shows only one type of machine we build for color filling of lettering and design with enamel. Send samples of parts you wish to fill for estimates.



The ACROMARK Company

426 Morrell St., Elizabeth 4, N. J.

"The Original Marking Specialists"

For additional information Circle No. 107 on the Reader Service Card

LUSTER-ON®

makes the difference

At less than 1/5¢ per square foot you can have brilliant finishes like this with Luster-on Utility bright dip for zinc. It's easy to apply and control and there's plenty available — no shortages. Every day former users of nickel and cadmium are converting to this passivating bright dip.

CHECK LIST

Do you produce parts like those listed below? Then you can obtain corrosion-resistant, brilliant finishes at lowest costs with Luster-on Utility 15 or 25.

- √Cabinet Hardware
- √Small Tools (wrenches, etc.)
- √Auto Body Parts
- √Bathroom Hardware
- √Aircraft Metal Parts
- √Wire Goods
- √Refrigerator Shelves
- √Radio Speakers, Chassis, Shields
- √Television Parts
- √Electrical Parts
- √Air Conditioning Fans, Guards, etc.
- √Bolts, Nuts, Washers, etc.
- √Builders' Hardware
- √Outdoor Metal Articles (fences, trailers, etc.)

Also

Protective Finishes

Khaki Drab Luster-on

With 300 hours of salt spray resistance Luster-on Khaki Drab far exceeds U. S. Government Specifications of 96 to 100 hours. This chromate type conversion coating has been developed primarily for electro-deposited zinc plate. It is also ideal as a paint bonding treatment for later organic finishes.

SEND SAMPLES

Send us samples of your parts. Let us zinc-plate and LUSTER-ON treat them for you — at No Charge. This will show you how you can dress up and protect your product simply and inexpensively with Luster-on.

THE Chemical CORPORATION

66 Waltham Ave., Springfield 9, Mass.

Circle No. 92 on the Reader Service Card

UNICHROME Trade Mark

News about
COATINGS for METALS
Metallic ..... Organic ..... Decorative ..... Protective

Specifications on corrosion resistance met by these

Two Ways to Chromate-Finish Zinc

Primer protection for light metals

Unichrome Primer AP-10 offers the two properties that insure durable finishing of magnesium, aluminum and other metals. (1) Great resistance to corrosion even by itself. (2) Strong adhesion even under tough service conditions. That's why it actually improves the life of finish coats. For example: Magnesium panels were primed with AP-10; others with a standard primer. All were given identical finish coats and then tested in salt spray. After 100 hours, panels with Primer AP-10 had developed no corrosion, whereas the others had failed completely.

CLEAR ENAMEL SAVES THOUSANDS OF DOLLARS

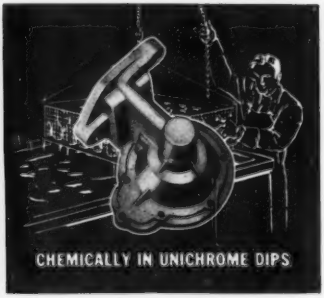
A clear enamel over today's decorative chromium finish gives extra protection against moisture, handling, corrosives. Using a special Unichrome Coating, one well known manufacturer is getting not only superior protection on plated refrigerator shelves, but also twice the film thickness at half the cost of the coating formerly used. Savings reported for the year: $15,000.

Better Protection Against Chemical Attack

Because Ucilon* Protective Coatings resist many strong chemicals, they're being used today in a wide variety of tough applications. On plating machines, for example. Also on bottling machines and on processing equipment. Use of these coatings means less corrosion and better appearance with less maintenance. Ucilon Coating Systems are available to withstand acids, alkalies, salt solutions, oxidants, moisture, petroleum products, alcohols, fumes and other corrosives. Write for Bulletin MC-4.

*Trade Mark

ELECTROCHEMICALLY IN "ANOZINC"


CHEMICALLY IN UNICHROME DIPS

■ Government specifications which call for chromate treating of zinc plate, do so to assure protection against corrosion. Several methods of chromate finishing are available to do this job. This gives the user freedom to choose the particular process that's best suited to his product, and offers production or cost-cutting advantages.

Two Unichrome Processes are widely used today because they can not only meet or exceed specifications, but also provide substantial benefits to the user.

A TOUGHER COATING THROUGH ANODIZING

The Anozinc* process, using conventional plating equipment, produces black, yellow or clear chromate type coatings on zinc plated parts by means of current. An exclusive process, it provides a finish with not only the desired corrosion resistance, but also superior toughness while still wet. This means that parts can be handled at once, thereby minimizing the storage and drying space problem.

The Anozinc process can be set up in one continuous automatic cycle with the zinc plating, or for manual operations. Zinc plated steel shell cases are being turned out at a fast clip with this process, as are propeller blades and other vital work.

In forming conversion coatings, chromate treatments remove some of the zinc from the product. Consequently, there is a problem in recessed areas of the work, where zinc plates thinner than it does at the edges. Not with Anozinc, however. An anodizing process, it complements the zinc plating process. Its stripping action is less in recesses where the zinc plate is thin. With a straight chemical dip, more zinc would have to be deposited to compensate for non-selective stripping action.

UNICHROME DIP A SIMPLE PROCESS

Unichrome Dip Finishes, chemically produced, are adaptable for manual or automatic operation. They too inhibit corrosion and withstand exposure. Different solutions produce a black, olive drab, brass-yellow, iridescent yellow or clear chromate coating in 5 seconds to 2 minutes, depending on the solution used. These finishes, integral with the zinc surface, also make excellent bases on which to apply organic coatings.

As straight chemical processes, Unichrome Dips use simple equipment, need no generator or rectifier and minimize installation costs.

Unichrome Dips produce bright, glossy finishes. The black and olive drab finishes can provide the eye appeal of glossy enamel. Clear finishes are bright, and have an appearance similar to chromium.

BOTH ARE ECONOMICAL SOLUTIONS

Anozinc baths have exceptionally long life. Unlike chemical dips, they seldom need to be discarded. In mass production, this feature cuts operating expenses.

Compared with other dips, Unichrome Dips can save money, too. By using a Unichrome Dip instead of their "home made" chromate dip, one well known company cut cost of materials alone by one-third.

Write for Bulletin CC-1, or phone the nearest United Chromium office.

UNITED CHROMIUM, INCORPORATED

100 East 42nd Street, New York 17, N. Y. • Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto, Ont.

For additional information Circle No. 39 on the Reader Service Card

ZINC SUPPLY
continued from page 58

zinc is very much lower than at January 1.

7. World zinc reserves are more than twice as large as in 1931 in spite of continued accelerated use. Important consumers have studied the facts and concluded that adequate zinc supplies will be available for their future needs.

Attacking proponents of "conservation" who urge substitution of other materials for "scarce" zinc, the Institute points out, "Substitution which may result in improved products or reduced costs is understandable. This is a competitive matter. However, substitution which results in imperfect end products giving unsatisfactory performance is harmful and uneconomic, particularly when there are ample supplies of zinc and there is no need to curtail use."

"To continue to urge substitution when supplies are ample," the report emphasizes, "may also result in curtailment of production which, in the case of zinc, would be the very opposite of true conservation."

SIPI METALS CORP. IS NEW NAME FOR CHICAGO SMELTER

A change in company name has been announced by the Chicago smelting and refining firm of Silverstein and Pinsof, Inc., which became Sipi Metals Corp. effective September 1.

Founded in 1912, the company has used a trademark featuring the SIPI initials. The decision to change the name of the corporation represents an indication of the wide acceptance and recognition which has developed for the trademark.

Address of the company is 1720 Elston Ave., Chicago. The company produces a complete line of non-ferrous metal alloys, including die casting alloys. Among company facilities is a laboratory for analytical research and quality control.

SINTERCAST APPOINTS SALES REPRESENTATIVES

Sintercast Corporation of America, Yonkers, New York, announces the appointment of J. W. Mull Jr. of Indianapolis, Indiana, as their sales representative for Indiana, Western Ohio and Northern Kentucky. The Sintercast Corporation is engaged in the manufacture of tungsten carbide specialty items.

NAME NEW DIRECTOR

Commissioner George J. Earl of the National Metal Trades Association has announced the appointment of L. F. Hansen as director of industrial relations for the Association's headquarters in Chicago.

NEW Eclipse Reverberatory Furnace
Melts Brass, Iron and Aluminum
Offers production and metallurgical advantages never before obtainable in metal melting. Melts and preheats simultaneously. Speeds melting periods. Near-perfect combustion and controlled uniformity of bath produce highest quality homogeneous metals.
Increase melting capacity . . . conserve floor space
For continuous charging and pouring, the new Eclipse Furnace gives you six to eight successive heats per day, 600 to 4400 lbs. of metal per heat, at 50% lower fuel cost. Returns, gates and risers are charged with the ingot . . . on the job as metal is poured. No lost time between pouring and charging. Hot metal always available for casting. Turnings and borings can be charged direct without pre-melting. Combustion normally wasted is used for melting or preheating cold metal in the hopper.
ECLIPSE FUEL ENGINEERING CO. Rockford, Illinois
ECLIPSE FUEL ENGINEERING CO. OF CANADA, LTD., Toronto, Ont.
Eclipse
Eclipse Fuel Engineering Co., 1123 Buchanan Street, Rockford, Ill.
Please send your free catalog No. C-90.
Have the Eclipse man call to discuss my problem.
Firm Name
Individual Title
Address
City State
For additional information Circle No. 62 on the Reader Service Card

ACME

FOR A BETTER LIGHT METAL ENGINEERING SERVICE

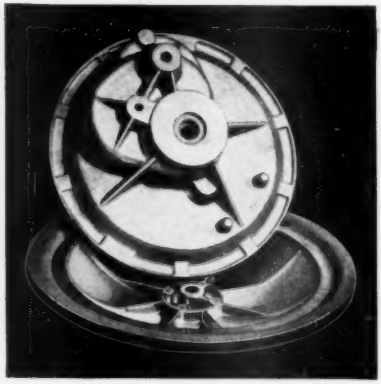
Six important words—"a better light metal engineering service"—may mean the difference between success and failure in using light metal castings.

Acme of Chicago has a *complete engineering service*. We will consult with you during the DESIGN stages of your product. This plan will save you headaches and money on production jobs.

Acme is interested in special castings, including steel inserts, heating elements and tubing.

Acme of Chicago offers a *complete casting service*—for aluminum alloy permanent mold and semi-permanent mold castings and aluminum and magnesium alloy sand castings.

Acme of Chicago is equipped to make light metal castings in quantities from ten to hundreds of thousands, and in sizes from a few ounces to several hundred pounds.



FOR PEACE

OR DEFENSE

PHONE
PROSPECT 6-5035

Write today

SEND BLUE PRINTS FOR ESTIMATES

ACME ALUMINUM FOUNDRY CO.

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REFERENCE MATERIAL, catalogs and data offered free in this month's ads (circle numbers on reader service card.)

4. PRECISION CASTINGS from frozen mercury patterns described in bulletin from Alloy Precision.

3. AUTOMATIC POURING of aluminum for col dchamber die casting is introduced by Ajax Engrg. in announcing new melting equipment.

5. ALUMINUM CASTINGS, alloys & facilities described in 80-page handbook from Aluminum Industries.

7. ALLOY SELECTION & design for investment castings in technical bulletin from Arwood Precision.

8. CONSTRUCTION FEATURES of die casting machines are explained in catalog from Cleveland Automatic Machine Co.

10. SMALL DIE CASTING machines are presented i ncatalog & spec sheets from DCMT.

11. DIE CASTING MACHINE that produces especially dense castings described in spec sheets from Cuyahoga Industries.

12. SMALL DIE CASTINGS produced by a specialized department of Dollin Corp. are subject of a booklet.

14. DIE CASTING FACILITIES of the Hoover Co., and data for the designer, in a booklet.

15. CATALOG OF DIE CASTING machines is offered by Hydraulic Press Mfg. Co.

16. PROPERTIES OF A NEW alloy of aluminum are listed in a brochure on Almag 35 from Wm. Jobbins.

17. SAFE OPERATING TEMPERATURES for hydraulic fluids in die casting machines by use of heat exchangers discussed by Kewanee-Ross booklet.

18. NEW DIE CASTING MACHINE is subject of catalog & specs from Lake Erie Engineering.

19. TWO-CHAMBER MELTING furnace in a bulletin from Lindberg Engineering.

20. LATEST NEWS on die casting machines & plastic molding in regular publication, The Lester Press from Lester-Phoenix.

22. ALUMINUM CASTINGS with attractive finish reported in booklet from Monarch on Velvaglazed aluminum castings.

23. NON-FLAMMABLE FLUID for die casting machines reviewed in 12-page booklet on Pydraul F-9 from Monsanto Chemical.

25. MELTING EQUIPMENT, crucibles & ladles for non-ferrous metals in catalog from Milles Foundry.

26. HYDRAULIC OIL FILTERS produced by Marvel Engineering are presented in a data sheet.

34. BARREL FINISHING is discussed in 3 booklets from Almco Div., Queen Stove Works covering the process, materials & equipment.

35. ECONOMICAL POLISHING of metals is well presented in booklet from Behr-Manning.

36. DATA SHEETS on two types of metal cleaners are offered by Cowles Chemicals.

38. NEW ELECTROCLEANER specifically for zinc die castings is reported in booklet from Oakite.

37. CONTACT WHEEL with interchangeable tired for abrasive belt operations is subject of literature from Carborundum.

39. TWO WAYS TO CHROMATE finish zinc are subject of technical bulletin from United Chromium.

40. PLASTER MOLD CASTINGS produced to close tolerances reported in data book from Atlantic Casting & Engrg.

42. SILVER-COLORED die lubricant for die casting is subject of brochure from Houghton.

44. STANDARD TESTING equipment for determining green strength of metal powder compacts is the subject of literature from Metals Disintegrating.

45. FACILITIES FOR PRODUCING powder metal parts, and review of scope of powder metallurgy, from Michigan Powdered Metal.

46. DIMENSIONING DIE CASTINGS is the subject of a guide book from Newton-New Haven Co.

48. POWDERED METAL PARTS, their production & uses, are described in bulletin from Powdered Metal Products Co.

49. LOW-FREQUENCY INDUCTION melting furnaces for non-ferrous melting are included in catalog & spec sheets from Russ Electric Furnace Co.

52. IRIDITE PROTECTIVE systems for corrosion-resistant metal surfaces are outlined in brochure from Allied Research.

53. BACKSTAND BELT GRINDING and polishing are the subject of a booklet from Armour & Co.

54. FASTER MACHINING of die castings through use of air controls is indicated in Bellows Foto Fact File of case histories.

55. BARREL FINISHING using materials & equipment from Minnesota Mining & Mfg. is explained in a booklet.

continued next page

POWDERMET SUCCESS STORY NO. 12

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For additional information Circle No. 48 on the Reader Service Card

56. ROTO-FINISH METHODS of barrel finishing can be learned from literature offered by Roto-Finish, Inc.

60. CAST MASTER die casting machines are in catalog from Cast Master, Inc., giving all specs.

62. REVERBERATORY FURNACE for die & permanent mold casting is new equipment described in Eclipse Fuel brochure.

64. ZINC ALLOY SUPPLIERS, Henning Brothers & Smith, offer a monthly house organ cal'ed The Henning Messenger.

65. HOW TO DESIGN aluminum & magnesium die castings is the subject of a data book from Litemetal Dicast.

66. BRASS POWDER PARTS are the subject of a 32-page handbook compiled & published by New Jersey Zinc Co. Basic design information included.

68. CONTROL OF METAL DRIP between faces of die casting dies is covered in literature from Ring Valve.

71. PLATING BARRELS described & illustrated in new catalog from Daniels Plating Barrel.

72. CLEAR LACQUER suitable for protective coating on all metals, is described in technical data bulletin from Maas & Waldstein.

73. ABRASIVE CLOTH backed by brushes on a special Sand-O-Flex head for finishing castings in catalog from Merit Products.

74. DIE CASTING FOR DEFENSE is the subject of a booklet "We're Geared for Your Defense Needs" from Advance Tool & Die Cast.

75. ELECTROLYTIC COPPER powders and other non-ferrous powders are covered in data issued by American Metal Co.

78. ALLOYS FOR INVESTMENT casting are described in literature available frrom Cannon-Muskegon.

80. SMALL DIE CASTINGS — review of size, alloy & design limits in folder from Gries Reproducer.

82. DESIGNING FOR POWDER metallurgy is subject of handbook from International Powder Metallurgy.

86. STANDARD POWDER METAL bearings from stock are introduced in booklet from National Molded Products.

88. INVESTMENT CASTINGS that cut costs shown in literature from Rode Company.

94. SOLVING PROBLEMS with investment castings is subject of booklet from Hitchiner.

95. GUIDE TO INVESTMENT casting applications is available from Investment Casting Co.

96. ELECTRIC FURNACE for small batches used in investment casting operation subject of catalog from Detroit Electric Furnace.

97. TRIAL SAMPLES of stearates that give higher green strength for powder metal compacts are offered by Metasap.

98. REFERENCE FOLDER on a line of P-V investments for the investment casting process is offered by Pre-Vest.

101. AIR CLAMPS and other air control devices are included in catalog from Mead Specialties.

105. TOOLS FOR DIE WORK & a regrinding service are in "All Star" catalog from Severance Tool Industries.

109. ELECTRIC FURNACES for sintering powdered metal parts are subject of booklet from Harper Electric Furnace.

110. TWO SPECIAL COMPOSITIONS used for powdered metal parts are described in a booklet from Bound Brook Oil-less Bearing.

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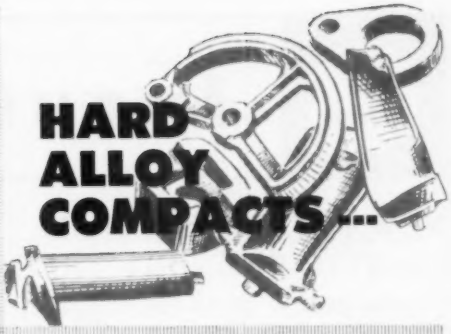

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INDUSTRY NEWS

NEW PRECISION STEEL CASTING FOUNDRY ERECTED

A new 8,000 sq. ft. foundry and office building has been erected by the Mir-O-Col Alloy Co., Inc., 340 No. Avenue 21, Los Angeles 31, Calif., to expand its present production of precision steel and alloy castings.

New equipment installed in the Mir-O-Col foundry include a 50 KVA induction furnace fitted with 100 and 200 pound crucibles, and two gas kilns used to preheat the molds prior to their pouring. "The preheating of the mold to a temperature close to the melting points of the metal is necessary," states John Skoning, foundry manager, "to secure sound precision steel and alloy castings."

Employing the "Hot Ceramic Mold Technique," the castings, it is claimed, are delivered within tolerances of .001 per inch. They have a 125 R. M. S. surface finish and are free of porosity and other defects commonly found in sand castings. Currently the foundry is pouring castings ranging from one to 25 pounds in weight.

The mold material replaces the conventional sand, for pouring all normal aircraft, ordnance, electronic and industrial alloys, including the stainless steels. The technique is also said to be adaptable to the precision casting of titanium and zirconium metals and their alloys.

E. P. CARNEY HONORED BY METALS DISINTEGRATING

Elvin P. Carney, chief control chemist of Metals Disintegrating Co. Inc., Elizabeth, N. J. manufacturers of metal pigments metal powders and metal abrasives, was recently the guest at a dinner held in his honor, celebrating his 25 years of service with the company.

E. P. Carney

Prior to this joining the MD organization, Mr. Carney was a chemist for a number of years with the National Lead Company. A graduate of Pratt Institute, he is a member of the American Chemical Society, the American Society for Metals and the Electrochemical Society.

F. J. STOKES MACHINE CO. OPENS CINCINNATI OFFICE

Extending its program of sales and engineering coverage by its own organization, the F. J Stokes Machine Company, Philadelphia Pa., has established a new district office at 2904 Woodburn Street, Cincinnati, Ohio.

The new Cincinnati office will serve users of Stokes equipment in southern Ohio, southern Indiana, all of Kentucky, and West Virginia except the Panhandle. It will be under the supervision of M. S. Adler, Cleveland manager for Stokes, and in immediate charge of Theodore G. Debreceni.

JOHN A. ZAPF DIES

John A. Zapf, chairman of the Board of Directors of the Schultz Die Casting Company of Toledo, Ohio, died Saturday, August 9.

MERCAST PRESIDENT TO VISIT EUROPE

S. J. Sindeband, executive vice president of the Mercast Corp., New York. N. Y. and president of its licensee, Alloy Precision Castings Co., Cleveland, O., spent the month of August abroad studying European production problems.

S. J. Sindeband

Following an intinerary that included England, France, Germany, Italy and Holland, Mr. Sindeband returned the visits of many of the European industrialists who came to Cleveland to personally investigate the use of mercastings (frozen-mercury investment castings).

HPM MOVES OFFICE

The Hydraulic Press Mfg. Company, Mount Gilead, Ohio, has announced that its Eastern District office has been moved to 352 Cedar Lane, Peoples Trust Company Building, Teaneck, New Jersey. The company's Eastern District office was formerly located at 500 Fifth Avenue, New York 36, New York. Continuing in charge of the office is regional manager, C. J. Ziegfeld, and T. G. Bishop, sales engineer.

SPECTROGRAPHIC ANALYSIS
continued from page 48

ity and the overall intensity by employing a counter-electrode of graphite packed with ammonium chloride. By utilizing two 30-second sparkings and two packed counter-electrodes, he was able to obtain good accuracy and a slight increase in sensitivity.

An entirely different solution to the problem was furnished by the Applied Research Laboratories Multisource. A number of workers utilizing this source for the analysis of zinc and zinc alloys found that by making the sample negative and a graphite counter-electrode positive, and by utilizing quite an arc-like discharge — C=40uf; L=350uh; R=50ohms — very high sensitivity was obtained for the lead, cadmium, and tin determinations. This sensitivity was increased four to five fold over the above high voltage spark methods so that determinations down to the .0002-.0003 percent level became possible.

When the ARL Quantometer Division was first presented with the problem of providing direct-reading analysis of zinc alloys, these various approaches to the solution of the

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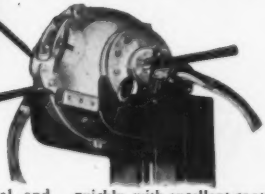

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problems were considered. Besides the usual considerations of sensitivity and accuracy, a new one became important. That was over-all speed of analysis. In order to make this as high as possible, methods employing both sparking and arcing of the sample with a total discharge operating time of over 100 seconds appeared to be excluded. With this in mind the Multisource discharge mentioned previously was studied in great detail by means of the Quantometer with the hope that sufficient accuracy might be obtained for aluminum in the 2-6 percent range and copper in the .5-4 percent range so that a single arcing would suffice. This has been accomplished utilizing the conditions shown in Table II. With a total elapsed time of arcing and recording of less than 40 seconds, a complete analysis is obtained of any of the zinc die casting alloys.

The precision of analysis under these high-speed operating conditions is as good as has been

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obtained by any other methods to date. However, several precautions must be taken to insure reliable results. A very high degree of cleanliness must be maintained at the arc-spark stand, at the machined face of the sample, and particularly at the counter-electrode. Any accumulation of oxides usually produces erratic lead, aluminum, and magnesium results. A single 12" piece of graphite must be utilized for calibration and for all subsequent analysis. Since this provides over 100 arcings, it is no serious limitation.

The precision to be expected for this method is shown in Table III. With regard to accuracy, this can be made to approach the precision by employing adequate duplicate standardization about every hour. Separate kinds of direct-reading recording paper should be utilized for each of the three common die casting alloys as the differences in copper content of these alloy types affect the analytical curves for the various elements to a slight extent. However, the interrelation between the various curves remains so that standardization with one type suffices to adjust the instrument for the analysis of all alloys.

The method described here has been checked practically in a number of laboratories to date. The work being done on the Production Control Quantometer at the Morris P. Kirk Company of Los Angeles represents the most extensive use of the method at this time. Their entire production of zinc die casting alloys is now successfully controlled in this manner.

---

[1]Quantitative Analysis with the Spectrograph by C. C. Nitchie. Industrial & Engineering Chemistry, Anal. Ad. 1 1-7 (1929).

[2]ASTM E 26-35T 1935

[3]ASTM E 27-43T 1943

[4]Apex Smelting Die Cast Method ARL Spectrographer's News Letter, Vol. 2, No. 1

[5]Quantitative Spectrochemical Analysis of Zinc Die Casting Alloys by M. F. Hasler and C. E. Harvey Ind. & Eng. Chem., Anal. Ed. Vol. 13 (1940)

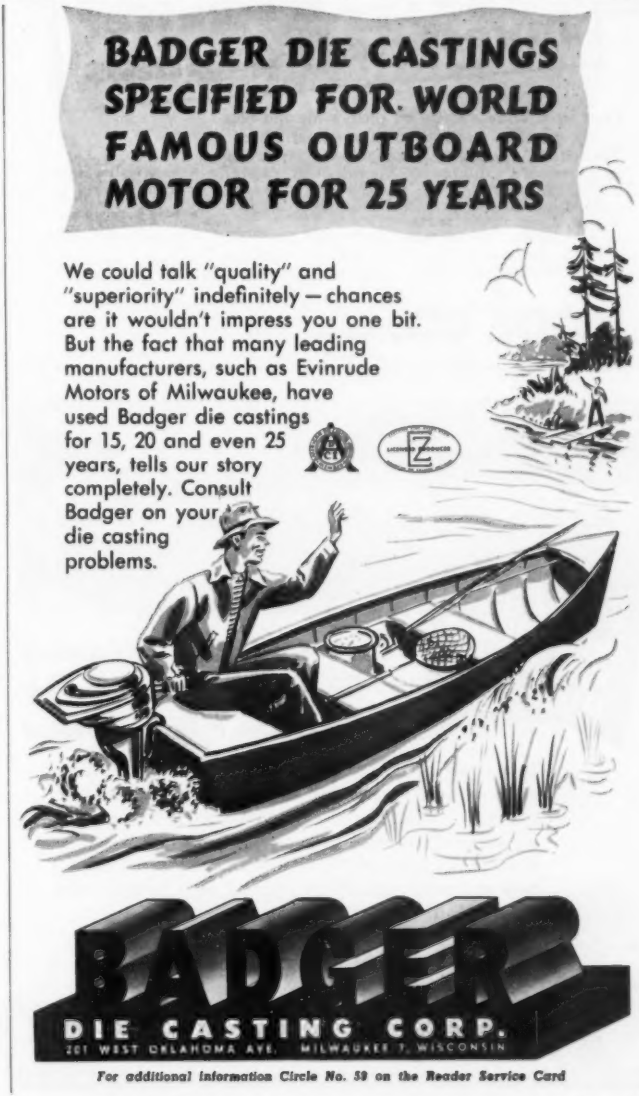
[6]Tentative ASTM Method SM VIII-3 by R .W. Smith A. C. Spark Plug Division GMC

[7]Spectrographic Analysis of Zinc Base Alloys by L. Larrieu Ind. & Eng. Chem. Anal. Ed. 18 403 (1946)

HOT FORGING
continued from page 39

also to sub-surface oxidation, which, if allowed to occur, will evidence a detrimental effect on the mechanical properties as well as the microstructure of the finished article.

The second consideration in the concept of a porous preform, is brought out during the con-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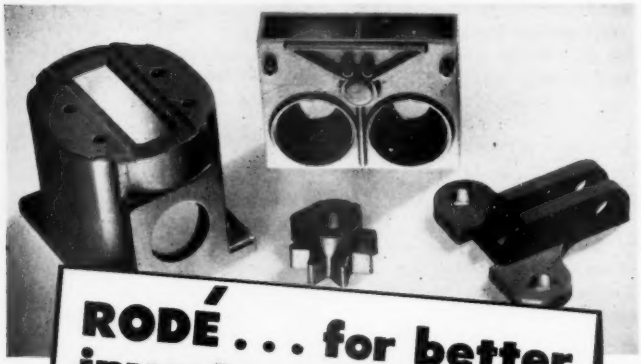

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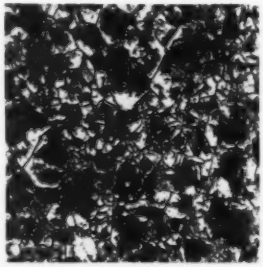
sideration of the plastic deformation which takes place during the hot coining. In normal forging of wrought bar stock, the flow of metal may be considered as analogous to that of a viscous fluid, which is substantially incompressible. On the other hand, the introduction of porosity in the material to be forged, completely invalidates any calculations which may be made concerning the direction or amount of plastic flow taking place during the forging. It may be easily seen, that throughout such a porous preform, there will be areas of very highly deformed material near the surfaces of the original particles adjacent to areas which have



4. RESULT OF AGING structure shown in Fig. 2 for 16 hrs. at 1500F.

been subject to hydrostatic pressure alone. Fortunately, the distance between the highly strained areas and the relatively unstrained areas is extremely small and hence, the resulting material, after re-crystallization has taken place, is entirely homogeneous.

A third ramification is the consideration of the large specific area of the porous preform as compared to that of wrought forging stock. It is because of this increased surface that the pre-heating atmosphere must be very carefully controlled in order to prevent decarburization when dealing with carbon bearing alloys. This atmosphere must necessarily contain a certain amount of hydrogen, or hydrogen bearing compounds in order that the preform may be safely transferred from the furnace to the hot coining die. It is a well known fact that most

metals will absorb many times their own volume of hydrogen when heated in a hydrogen bearing atmosphere, and will evolve this hydrogen upon removal from the atmosphere. It is this evolution of the occluded hydrogen that protects the porous preforms from ambient atmosphere during the furnace to die transfer period.

The same phenomenon necessitates the de-gassing operation stated in Step 4 of the hot coining process since although a certain percentage of the occluded gas is evolved during the transfer period, perhaps the larger percentage is entrapped within the specimen during the sudden densification. This entrapped gas can generally be removed by holding the specimen in air at a fairly low temperature for approximately one hour.

Experimental Results

Several alloys, both ferrous and non-ferrous, have been subjected to hot coining and in all cases to date investigated, have exhibited physical properties and response to heat treatment, either identical to or superior to the same material fabricated by conventional forging practice.

For example, one advantage incident to hot coining is illustrated during a consideration of a cobalt base high temperature alloy. In most alloys of this nature when fabricated by conventional coining and subsequent forging techniques, the carbon in the form of complex carbides is usually found as fairly large inclusions in the microstructure. These carbides are formed during the solidification of the alloy form the melt and once formed, cannot economically be placed back into solid solution through heat treatments. Some dispersion of the carbides is brought about during the mechanical working in the forging operation, but in general, the carbide remains rather localized.

It has been felt for some years that if a generalized distribution of this carbide could be effected, the physical properties of the alloy could be con-

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siderably improved. By the very nature of their manufacture, each individual particle of pre-alloyed metal powder is in the ideal state for the achievement of the above-mentioned generalized carbide distribution, i.e, a supersaturated solid solution. These particles, when re-united at a temperature below the formation temperature of the massive carbide, can then be heat treated to bring about precipitation of the carbon as small, almost spheroidal carbides, uniformly distributed throughout the aggregate mass.

The size of the precipitated carbide particles is a function of the precipitating temperature, or in other words, of the hot coining temperature. Certain alloys of the cobalt base group have been fabricated experimentally into test pieces at various hot coining temperatures and subsequently heat treated.

Figure 1 illustrates the non-homogeneity of grain size immediately after the hot coining operation on a small test piece. Note the extremely fine grains delineating the original particle surfaces and the scattered, almost spheroidal carbide distribution.

After a homogenizing heat treatment, the structure of Figure 1 is transformed to that shown in Figure 2. Note that the original particle-to-particle interfaces are no longer visible and that the carbide distribution is similar to spheroidite in steels.

When the heat treating temperature is increased sufficiently, the carbide apparently goes into solution but reprecipitates immediately as a lamellar type of carbide formation at the grain boundaries. The transition steps from the structure shown in Figure 2 to the grain boundary carbide condition is illustrated in Figure 3.

The structure shown in Figure 3C suggests a eutectic melt at the grain boundaries and it was first thought that the migration of the carbon to the grain boundaries caused incipient fusion to take place. It was found, however, that the alloy

could be hot coined at temperatures considerably above this formation temperature with no evidence of the material being "hot short" thus indicating that the above conception was incorrect.

In order to prove conclusively that the structure in Figure 3C was a carbide formation rather than a melt, a bar of the material was suspended from the wall of a furnace between two heating elements and its temperature raised to three hundred degrees above the carbide formation temperature. No warping or bending of the bar resulted as would have been the case had the structure been the result of insipient fusion. Figure 4 shows the result of aging the structure shown in Figure 2 for 16 hours at 1500 F.

The room temperature tensile properties of specimens prepared from metal powders by hot coining are shown in Table 1 in comparison to the cast material.

A comparison of short time elevated tensile tests of the hot coined and heat treated alloy with comparable values obtained from cast materials is presented in Table II. The ultimate tensile strength of the hot coined parts are somewhat lower than the cast material but in most all cases the ductility of the hot coined parts is considerably higher.

When tested in stress-rupture, the hot coined specimens compare to the cast material as shown in Table III.

Table IV shows the results published by J. P. Scanlon on the hot coining of two steels prepared from prealloyed powder and one from primary component powders.

For the alloys investigated in this laboratory, it was found that the hot coined parts were either close to or exactly 100% dense and responded to heat treatment identically with samples of the wrought material.

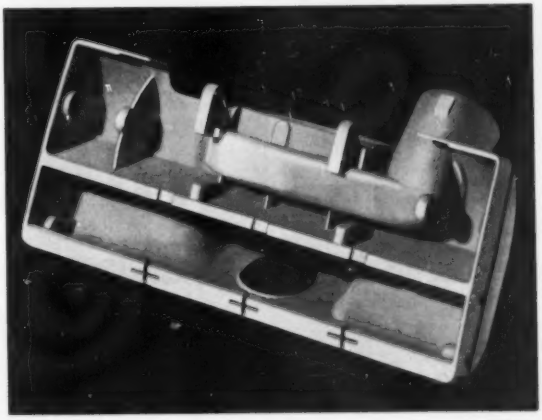
Analysis of the work conducted on the hot coining process to date definitely indicates that

TABLE IV

Physical Properties of Hot Coined Alloys

Normalized 1670°F., Oil Quenched From 1575°F., Tempered at 600°F.

		SAE 8730	SAE 4620	Electrolytic Iron + .40% Graphite
Yield Point		224,000	159,000	182,000
Tensile Strength		240,000	163,000	190,000
Elongation	%	9.5	11	—
Reduction in Area	%	30.5	26.8	26.5
Rockwell A		74	68	71
Carbon	%	.30	.11	.40
Density	g/cc.	7.80	8.7	7.72



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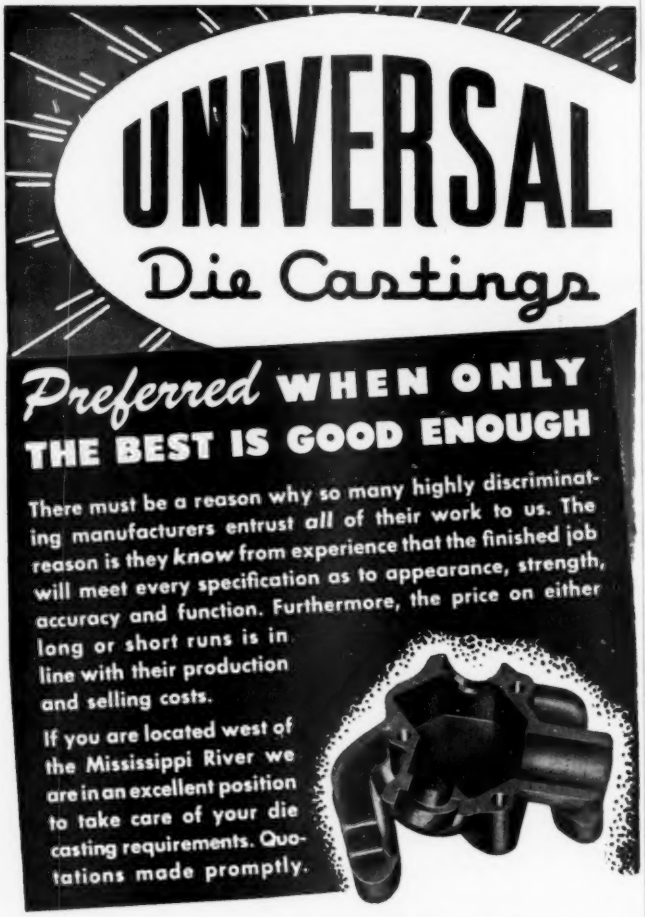
his technique can and probably will within the next few years, begin to compete commercially in the fabrication of small forged parts. It may be readily seen that several of the normal forging steps such as upsetting and forming operations are bypassed through the use of metal powders.

The elimination of these steps results in a saving of material, die costs, and labor costs and yet the end product, produced by powder metallurgy, is physically and metallurgically identical to that produced from wrought material. Some preliminary cost estimates of complex parts produced by this method have shown that cost savings up to 25 percent may be recognized when this process is put into commercial use.

Although the process is still in the experimental stages and a certain amount of development work is still necessary before the full benefits incident to the process are to be realized by industry, it is believed that hot coining will, in the not-too-distant future, establish its niche in the American industrial picture.

The author wishes to express his appreciation to Prof. G .J. Comstock and Dr. F. H. Clark, Stevens Institute of Technology for their technical advice and to the Bureau of Ships, Department of the Navy under whose sponsorship much of this work was conducted.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PROMOTIONS AND APPOINTMENTS

Three new sales staff appointments announced by *Kaiser Aluminum & Chemical Sales, Inc.* include: RICHARD E. HANSON, manager of the firm's Kansas City district office to be assistant to the general sales manager in the Chicago office; WALLACE A. DAVIDSON to be manager of the Kansas City office; and DONALD F. SHERIDAN to be branch representative of the Wichita, Kans., sales outlet.

HENRY M. CLOUSE has been named assistant engineer in the *Allis-Chalmers* foundries and pattern shops.

WILLIAM J. KINGSLEY has been named assistant general sales manager of *The Carborundum Company.*

Four appointments to newly created executive positions on the engineering staff of *Carboloy Department of General Electric Company* have been announced, including E. W. ENGLE, product and process engineering manager; E .E. GEORGE, design and application engineering manager; R. A. CANNING, production engineering manager; and R. L. BROWNLEE, administrative engineer.

AUGUST R. RYAN has been named manager of sales for furnaces and associated equipment of *General Electric Company's* Industrial Heating Department.

JOHN ALICO has joined *Lake Erie Engineering Corp.* of Buffalo, N. Y. as project engineer.

G. R. WAITKINS has been named assistant manager of the St. Louis Research Department of *American Zinc, Lead & Smelting Co.*

RUSSELL V. MILLS has been appointed field engineer in the East Boston Massachusetts territory of *The Bellows Co.*

A. P. METZGER of Perrine, Fla., has been chosen to represent *Gries Reproducer Corp.* in Florida.

ERNEST S. KOPECKI has joined the public relations department of *The Carborundum Co.* in Niagara Falls, N. Y.

JERRY MELGAARD has joined the magnesium sales staff of *The Dow Chemical Co.* in their Chicago, Ill., sales office.

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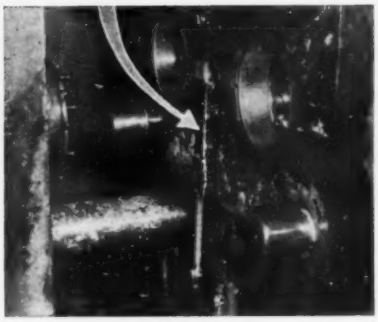

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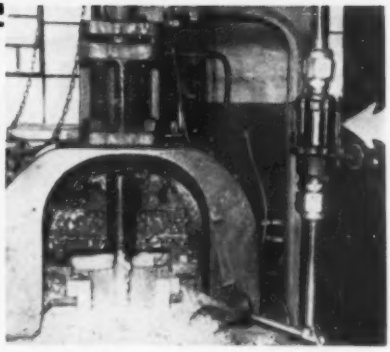

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PRECISION CASTINGS ACQUIRES BRADLEY-EDLUND

Precision Castings Co., Inc., of Fayetteville, N. Y., has acquired the Bradley-Edlund Corp. of Cortland, N. Y., through an exchange of stock, Arthur G. Chase, president of Precision has announced. There will be no change in the active management of the corporation, and Emery A. Dunning will continue as vice president and general manager in charge of the Cortland plant.

Bradley-Edlund Corporation manufactures forging hammers, standard and special purpose drilling and tapping machines, and other types of special purpose machinery at its plant in Cortland. It also owns a plant at 432 North Franklin St. in Syracuse which is now leased to Precision and is presently used for the production of die castings, assembly of Ordnance fuzes for the Army, production of Infantry mortar tail fins and plating in silver and other precious metals.

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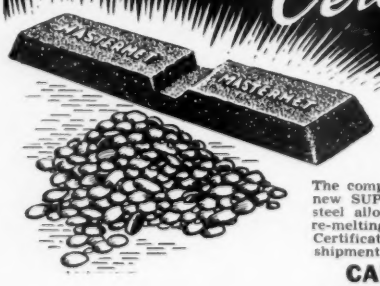

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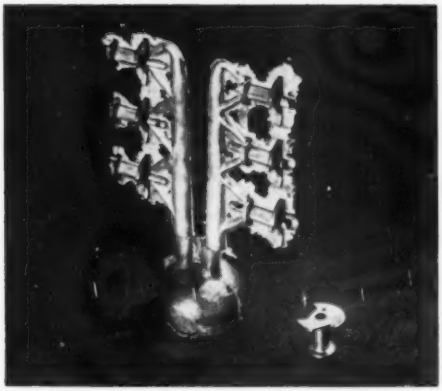
SIMPLIFIED SOLUTIONS

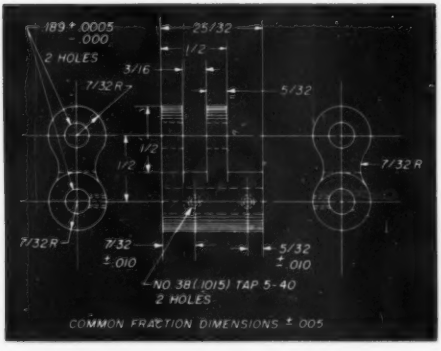
for production problems



MULTIPLE CAVITIES—giving several parts simultaneously, — makes die casting an inexpensive way to form complex shapes like this small brass cam used in an automatic telephone. The amount of work to fabricate this piece by staking two stampings to a piece of tube is apparent. The gate of castings produced by Pressco Casting & Mfg. Corp., in Chesterton, Ind. reveals how this complicated shape is cast 6-up, requiring only trimming and minor machining.

RESISTANCE TO WEAR AND IMPACT is the principle requirement of this link, below. To secure both of these important properties and, at the same time, reduce the cost of manufacturing, The Eagle Signal Co. of Moline, Ill. now has the part made of iron powder, infiltrated with copper.

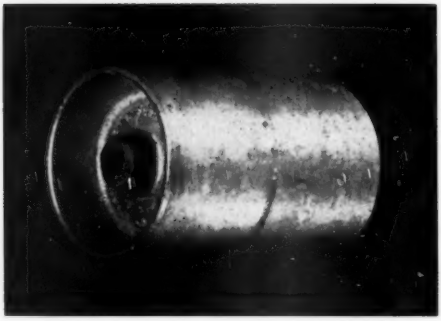
As made by the Chicago Powdered Metal Products Co., of Chicago, Ill. this link, used to connect mechanically and electrically actuated components, replaces what was formerly a two-piece assembly. Except for the two lateral set screw holes which can not be molded in, the link is made to blue print specifications. The 0.189 diameter holes are reamed after molding and sintering to maintain the required tolerance of ± 0.0005 -0.0000



ONE-PIECE TWEEZERS? This is easily accomplished by investment casting, as is demonstrated by the surgical tweezers, above, produced by Continental Casting Corp., New York. These tweezers have no assembly operations, and have some fine teeth in the working ends, cast to size. All that is necessary is to cut off the sprue and electroplate the casting.

SIMPLIFIED SOLUTIONS

for production problems

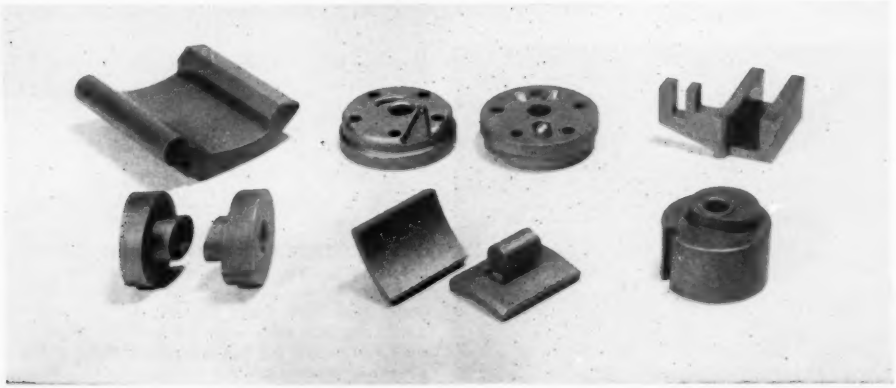


A BLIND CYLINDER with a deep hole and thin wall is a difficult part to make under the best of conditions. When these two features are combined with several steps to give changes in wall thickness and a semi-spherical closure the production department is given a choice of only two methods of manufacture; either machining from bar stock or die casting. Since machining such a part from bar is economically unsound, only die casting remains as a production method. The part, left, combining all of the undesirable features noted, is being successfully made in aluminum by the Gem Die Casting Co. of Denver, Colo.

As can be seen from the photograph, this particular part, a component of an airplane trouble light, presents a number of problems in die design. The entire thin wall section is, of necessity within the movable die half with the gate at the parting line. Ejection is by a single pin, centrally placed. Only by very precise control of casting conditions is it possible to secure good metal flow.

Because of the use to which the part is put, a good as-cast surface is required and draft on the O.D. and the long core pin must be held to an absolute minimum.

DESIGNERS WHO THINK powdered metal parts are limited to simple shapes with uniform section and regular contour should take a second look at the group of powdered iron parts, below, produced by Amplex Manufacturing Company of Detroit. Attention is called to a pair of mating cams in the foreground, as well as sliding block with curved face. Shapes having multiple depths, blind holes, keyways, complex curves and other special details are readily produced.



A PMM DESIGNER'S REFERENCE TABLE

This tabulation of alloys now being successfully cast in plaster molds should be useful for reference purposes in designing. Future tabulations of metals and alloys processed by other PMM techniques are scheduled. For a report on plaster mold castings see page 40.

PLASTER MOLD CASTING ALLOY SPECIFICATIONS †

NOMINAL VALUES	No. 10 YELLOW BRASS	No. 20 ALUMINUM BRONZE	No. 31 High Tensile MANGANESE BRONZE	No. 40 High Strength ALUMINUM (Tenzaloy)**	No. 60 ALUMINUM ALLOY
Nominal Physicals*					
Ultimate Tensile	50,000	70,000	100,000	26,300	16,500
Yield Point	25,000	40,000	60,000	19,500	15,000
Elongation % in 2 in.	12	7.0	7.0	6.0	1.0
Brinell	100	160	190	. . .	. . .
Patterns Required	Open Flask	Full Flask	Open Flask	Open Flask	Open Flask
Nominal Chemicals					
Copper	58.00	82.50	65.00	0.8	1.30
Zinc	40.25		23.00	8.0	
Tin	1.00				
Lead	.75				
Aluminum		11.25	5.00	Balance	93.50
Iron		5.00	2.50		
Manganese		1.25	5.00		
Silicon					5.00
Magnesium				0.4	.50

† Supplied by Atlantic Casting and Engineering Co.
* Guaranteed values are somewhat lower.
** Results obtained from test bars aged two weeks at room temperature.

HOW PRECISE

continued from page 37

three inches of ± 0.002. Finally, the pouring temperature of the metal enters into the picture. Here, of course, there is a wide variation among the different alloys but for a pouring temperature difference of about 100 F, a casting variation of as much as ± 0.003 in three inches can result.

From this very short discussion of the effect of temperature variation on final dimensional accuracy, it is apparent that under the best of conditions, an uncontrollable variation of ±0.001 per inch can be expected and this may increase very considerably.

Another, though more easily controlled, variable that is temperature — dependent is the thermal expansion or contraction of the wax or plastic pattern at the time of investment. By close control of the temperature of the investment material, this variable can be held to an negligible amount. Inadequate temperature control, however, can have serious results. The curves in Figure 1 show that a change in temperature of 50 F can result in a variation of 0.0015 in three inches. While such a change is not great, when it is added to several others, the total becomes quite impressive. Admittedly, the variations can balance but the chance of their doing so is no greater than the chance that they will be additive, at least in part.

The basic accuracy of an investment casting is, of course, in the mold used to make the wax or plastic pattern. Within the limits of the ability of the die maker, the accuracy will depend upon how much the customer is willing to spend for dies and molds.. Working to tolerances of ± 0.005 is much less costly than working to ± 0.002. When the finer tolerances are required, the added cost may be justified, but in many cases completely outrageous tolerances are put on drawings only because it seems like a good idea, not because they are needed.

When a wax or plastic pattern is made, the mold for it must, of necessity, be openable. This will involve a parting line on the pattern. As is well known from other casting processes, the accuracy that can be held across such a parting line is considerably less than elsewhere. A variation of ± 0.002 per inch across a parting line should be considered as minimal.

Not all of the variables that can influence dimensional accuracy or dimensional reproducibility have been detailed. In fact, one prominent investment caster has listed some twenty different factors that can cause inaccuracies. However, for gen-

eral guidance, two rough rules of thumb can be used:

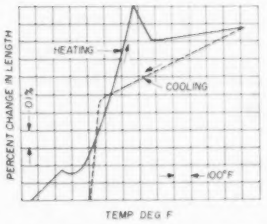
- Investment castings having dimensional tolerances of ± 0.005 per inch and dimensional reproducibility of 0.010 per inch can be consistently produced if only statistical quality control is required. This will mean inspection of roughly 10 percent of the castings.
- Investment castings having dimensional tolerances of ± 0.003 per inch and dimensional reproducibility of 0.006 per inch can be consistently produced if the part can stand 100 percent inspection. Tolerances and reproducibility finer than this should not be expected though may be possible in some cases.

Before leaving the subject of accuracy, a word about surface finish. This is another point which has been stressed and overstressed. When compared with a sand casting, the average investment casting does have a good surface. When considered in the light of measured surface roughness, however, an investment casting is not too smooth.

Actual measurements of surface roughness in the as-cast condition has shown that for ferrous castings, the average if 50 to 60 micro- inches RMS and for non-ferrous castings, the average is slightly below 50 micro-inches RMS. In commercial production, the best finish obtainable is in the order of 40 to 50 micro-inches RMS. Smoother finishes have been produced (as low as 20 micro-inches RMS) but only at excessively increased costs.

General types and classes of parts

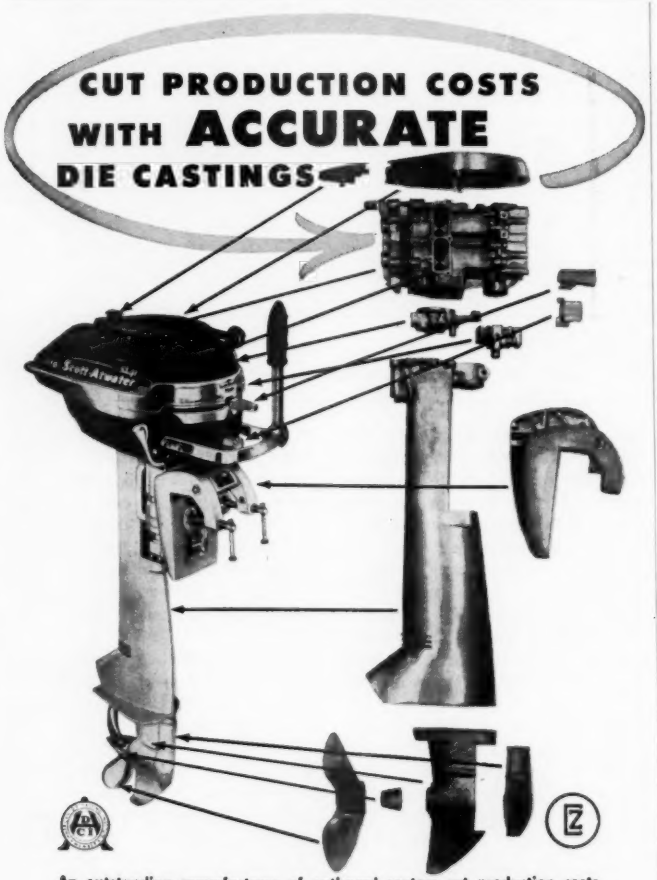
There has been such a voluminous literature on this particular phase of the investment casting industry that only a brief documentation of the broad classifications needs to be given here. Regardless of how much might be written, unless the designer is intimately acquainted with the field, there is nothing that can replace consultation with a reputable investment founder.



1. THERMAL EXPANSION of typical investment material is indicated by graph A change of 50F can result in variation of .0015 in three inches.

Briefly then, the general types and classes are:

- Parts made of metals and alloys that cannot be machined or forged.
- Parts whose shape is so



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complex that machining is excessively costly and where the tolerances and finish obtainable by investment casting are adequate.

- Parts made up by assembly of a plurality of smaller components.
- Castings too small to be economically made by sand casting and that can be investment cast less expensively than they can be machined.
- Parts requiring a large amount of machining where an investment casting can eliminate all or most of the machine work.
- Parts required in moderate to large numbers where other processes such as die casting, permanent mold casting or powder metallurgy are not applicable.
- Parts that cannot be made in any other manner.

While the above listing does not cover all of the possible classes that can be profitably investment cast, it will probably encompass the majority of them.

Properties of investment castings

Before considering the properties of investment castings, what metals and alloys can be used. Broadly speaking, any meltable metal can be investment cast. There are, of course, exceptions to this but not many. Not all foundries can cast all materials and it may be necessary to inquire of several before one is found that can handle the material in question. Whether some of the highly active metals such as beryllium, titanium, zirconium, and a few others can be handled still remains to be seen. At least one foundry claims to be able to cast titanium metal.

Alloy control in the invest-

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(a) Intricate spiral knife 3½ in. long x 2⅝ in. diameter
(b) "One-piece" surgical tweezers.
(c) Stainless steel sewing machine part.

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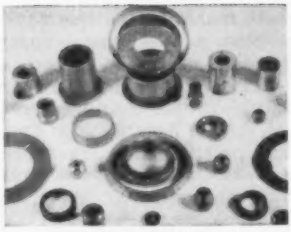

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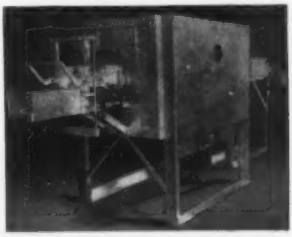

Model HOU-8436-MI-21 Harper Electric Furnace with cooling chamber for sintering, brazing, and annealing operations. Parts to be treated are charged and discharged manually in this alloy muffle furnace with water-cooled exit chamber. Simple sturdy construction of this unit, providing economy of atmosphere allows for maximum working at low investment cost.

Whether your heat treating requirements call for research or production units you will want to investigate the versatile features of Harper Electric furnaces for sintering metal powder products and other processes.

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ment foundry is as much of a problem as in a sand foundry. By the utilization of proper melting equipment, good scrap control, proper melting procedure and, in general, good foundry practice the investment foundry is able to maintain alloy composition as closely, and in some cases more closely, than is possible in larger melting shops. However, the mere fact that smaller heats are melted in no way insures better compositional control and the purchaser of investment castings must assure himself that proper foundry practices are followed if the parts are to be uniform from heat to heat. Recently, commercial sources of alloys in quantities and compositions specifically for investment casting have been introduced.

For general design information, it is safest to assume that investment castings will generally have the same physical properties as sand castings. This implies, of course, the same section thickness in both types of castings. There is some evidence that in heavier sections the investment cast metals will be more ductile than the same metal sand cast.

Well over 100 different metals and alloys have been investment cast. Data published by the various foundries shows considerable variation so that it is probably not safe to generalize. By far the best procedure is consultation with a foundry capable of casting the desired material and from them secure probable physicals. This again emphasizes that at present the design engineer should lean heavily on the foundry for advice when considering investment casting as a fabricating method.

Data and information from the following companies has been used, in part, in the preparation of this report.

International Nickel Co., Bayonne, N. J.
Crucible Steel Co., Harrison N. J.
Arwood Precision Casting Corp., Brooklyn, N. Y.
Precision Metalsmiths, Inc., Cleveland, Ohio
Midwest Precision Casting Co., Cleveland, Ohio
Adapti Co., Cleveland, Ohio

REPORT SHOWS INCREASE IN MAGNESIUM DIE CASTINGS USED FOR AUTOS

The increasing use of magnesium die castings by the automotive industry has been one of the major factors responsible for a 44 percent rise in the use of magnesium castings during the first six months of 1952, according to a report from The Magnesium Association.

The report, based on information received from the U. S. Bureau of Census, shows that 19,256,000 lbs. of magnesium castings of all kinds were shipped during the first sx months of 1952, as compared with 13,-321,000 lbs. during the last six months of 1951.

It is interesting to note, in the report, that the ratio of cast to wrought magnesium products has increased substantially during the past year. Shipments of wrought products from July to December 1951 totaled 9,300,-000 lbs. compared with 13,321,-000 lbs. of castings; by contrast, the first six months of 1952 shows 10,236,000 lbs. of wrought and 19,256,000 lbs. of cast magnesium.

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CHROMATE TREATMENT
continued from page 66

ment of the plated surface is eliminated.

In high frequency applications of aluminum it has been found that no practical difference results in the circuit from the use of Iridite.. For instance, for the "S" band range of 2600 to 3950 MCPS, the standard allowable attenuation range for clean aluminum with an RG-75/U wave guide section is 0.0064 to 0.0094 Db/ft. Iridited aluminum fell well within this range with an attenuation of 0.0084 Db/ft.

TABLE V

ELECTRIC PROPERTIES

TREATMENT	ELECTRICAL RESISTANCE PER SQ. IN. OF SURFACE	
	10-Psi Pressure	100-Psi Pressure
Freshly Cleaned Aluminum	1500 microhms	500 microhms
Aluminum plus Iridite No. 14	8000 microhms	1900 microhms
Aluminum plus Anodizing	Over 88 ohms	Over 800 ohms

TABLE IV

PAINT ADHESION

(One Coat Air Dry Lacquer, Bell Laboratories Adhesion Tester)

Surface Treatment	Max Load in Gm without Flaking	
	3S	24ST
Chromic Acid Anodizing	3500	5000
Phosphoric Acid	4500	2250
Caustic Etch Plus Nitric Acid	3750	5000
Iridite No. 14	5000	5000

Weldability

Experience with wrought stock has shown that Iridited work may be welded by the inert gas shielded arc method without removal of the film. The film protects the surface from oxidation between cleaning and welding and also has an apparent fluxing effect which

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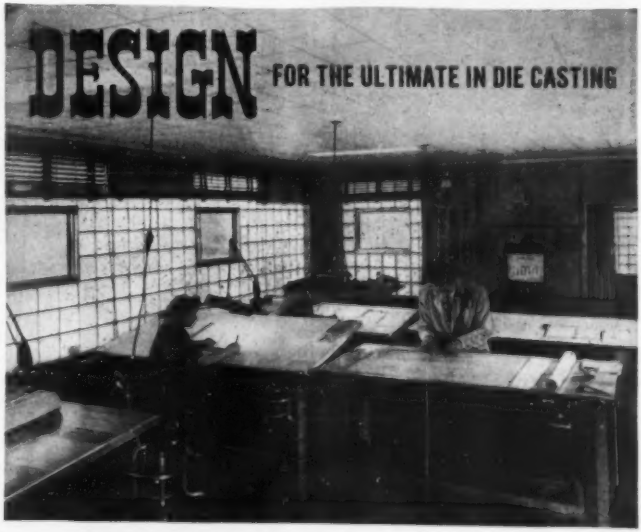

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results in a weld meeting the highest standards. Formerly it was necessary to weld immediately after cleaning the metal. It is now possible to store the work after treatment and weld as it is withdrawn from stock. Furthermore, treatment of detail parts permits smaller processing tanks than would be required if it were necessary to complete assemblies.

Where aircraft class B welds must be made, only the clear film should be used and treated work may be held for as long as a week before welding. Where no patricular pull-test standards must be met, the yellow coating can be spot welded.

Editor's Note: Part Two of this paper will be presented in the November issue of PMM, covering details of the techniques used to apply this chromate film.

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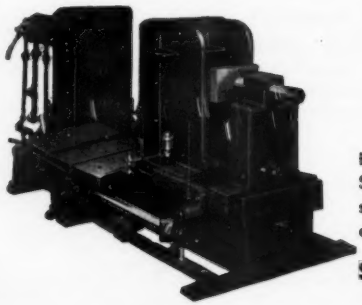

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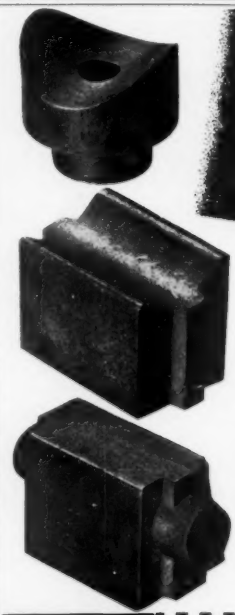

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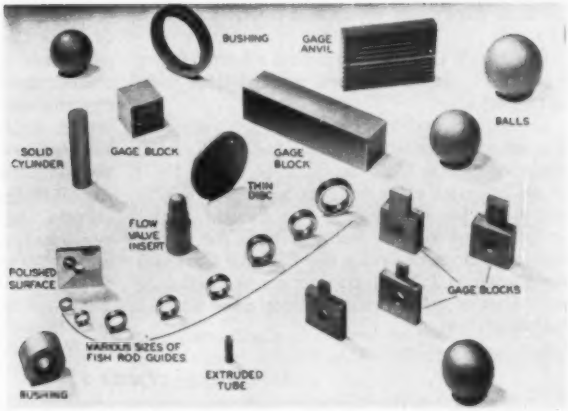

A FEW USES for the new chrome carbides are illustrated above.

POWDER METALLURGY develops a new material : the chrome carbides

By J. D. KENNEDY*

THE unusual combination of properties exhibited by Grade 608 chrome carbide, first of the new Series 600 cemented chrome carbides made by the powder metallurgy process to be made available by Carboloy Department of General Electric Company, is expected to lead to wide application of the new mancreated metal. Many preliminary successful applications, Figure 1, have already been made. These broad applications demonstrate the extent to which chrome carbides can be used by industry.

Physical properties and performance

The new metal is composed of 83% chrome carbide, 2% tungsten carbide and 15% nickel. Among its outstanding physical properties, Table 1, are its density, which is about half that of tungsten carbide, and its coefficient of thermal expansion, which approximates that of steel. Actually tungsten carbide has a

continued next page

*Manager—Wear Part Sales Carboloy Department of General Electric Company

TABLE 1

PHYSICAL PROPERTIES OF CEMENTED CHROME CARBIDE (GRADE 608)

HARDNESS	—88 Rockwell "A"	ABRASION RESISTANCE	—Good, some less than tungsten but much better than hardened steels.
DENSITY	—7.0 gms/cm³ (slightly lighter than SAE-1095)	RESISTANCE TO OXIDATION	—Only a slight surface discoloration after 24 hours in air at 1800°F.
TRANSVERSE RUPTURE STRENGTH	—100,000 PSI	RESISTANCE TO CORROSION	—Excellent
COMPRESSIVE STRENGTH	—Higher than most hardened steels.	MAGNETIC PERMEABILITY	—Non-magnetic
COEFFICIENT OF THERMAL EXPANSION	—6.4x10⁻⁶ in the range of 70°-1292° F.		

thermal expansion coefficient about half that of steel.

Grade 608 Chrome Carbide is a hard, strong metal and resists abrasion much better than hardened steel.

Corrosion Resistance—Salt spray tests conducted at Battelle Memorial Institute reveal that Series 600 Chrome Carbide retain their metallic lustre after being subjected to a 30% salt spray for 750 hours.

Results of actual chemical tests for corrosion resistance of Series 600 Chrome Carbides are shown in Table 2, comparing performance with that of other cemented carbide and 18-8 stainless steel.

Oxidation and Erosion—The Series 600 Chrome Carbides resist oxidation at all temperatures up to 1832F. When subjected to a temperature of 1850F for 24 hr. samples of chrome carbide are only slightly discolored, while simultaneously exposed samples of stainless steel and tungsten carbide have completely disintegrated.

Steam erosion tests show a resistance for chrome carbides about 50 times that of conventional carbides. Samples 1½ inches in dia. and 0.250 thick were placed ½ in. in front of a 350 psi jet of saturated steam passing

continued next page

TABLE 2

CHEMICAL TESTS
LOSS IN WEIGHT IN MILLEGRAMS PER SQUARE DECIMETER PER DAY
AVERAGE OF 10—24 HOUR IMMERSION PERIODS

Test	Chemical Used	Typical Applications	RESULTS				
			Series 600 Chrome Carbides	Other Cemented Carbides			18-8 Stainless Steel
				WC +Co	WC +TaC +TiC +Co	WC +TaC +Co	
1	10% H_2SO_4 (10% Sulphuric Acid)	Pickling acid, electroplating, in electrical batteries.	55	158	302	135	1650
2	50% H_2SO_4 50% Sulphuric Acid)	Manufacture of fertilizer, chemicals, explosives.	31	100	120	81	7300
3	37% HCl (37% Hydrochloric Acid)	Tanning leather, pickling acid, manufacture of ceramics, dyes, etc.	190	600	650	160	Total Loss
4	35% HNO (35% Nitric Acid)	Manufacture of explosives, organic chemicals, metallurgical refining processes, etc.	19	250	330	110	45
5	HNO_3—HCl (Aqua Regia)	Used principally for corrosion tests (even platinum corrodes). Also, metallurgical processing.	810	2820	4500	1550	Total Loss
6	NaBC1 .07 C1, PH 9 (Sodium Hypochloride)	Bleach paper, textiles. Also, water purification.	100	230	1000	158	11
7	5% NaOH (5% Sodium Hydroxide)	Manufacture of textiles, rayons, etc.	0.6	22	7	12	1.0
8	50% NaOH (50% Sodium Hydroxide)	Soap manufacture, petroleum refining, rubber reclaiming.	1.0	3	3	4	2.0
9	5% $CaCl_2$ (5% Calcium Chloride)	Road dressing, fire proofing agent, manufacture of pharmaceuticals.	0.3	41	24	27	1.3
10	1.0% Citric Acid	Manufacture of pharmaceuticals, soft drinks and flavoring extracts.	0.6	176	150	160	2.0
11	5.0% Lactic Acid	Manufacture of leather and textiles. Encountered in dairy industry.	1.5	200	170	255	5.1

through a 1/16 in. dia. nozzle for 25 hr. periods.

Four tests of 25 hr. each made with different but identical nozzle assemblies show no measurable erosion penetration on the chrome carbide samples after the first three tests. Maximum average penetration after the first 100 hours is 0.004 in. These tests show results equivalent to other metals with maximum resistance to steam erosion.

Available Sizes and Shapes —Grade 608 Chrome Carbide is already available in limited quantities in a variety of shapes for engineering and metallurgical test applications. Production facilities are being expanded to permit delivery of production lots soon.

When production facilities are completed, the new carbide will be available in approximately the same size and shape range in which tungsten carbide is now being offered.

Because costly and critical tungsten and cobalt are not constituents of chrome carbide, it is expected that complete parts can be economically made of solid chrome carbide in contrast to attaching individual pieces as has been done with tungsten carbide in the past. The light weight of chrome carbide is another factor in favor of this design concept.

Fabricating, finishing and attaching

Generally the same methods used in fabricating tungsten carbide are used for the new chrome carbide. Components can be molded to shape for standard or quantity parts. They can also be economically machined to required shapes in the presintered condition for small lot production. Grinding, lapping and polishing of chrome carbide is performed with conventional silicon carbide grinding wheels, diamond grinding wheels and diamond lapping compounds. Polished surfaces of chrome carbide have a more brilliant lustre than those of tungsten carbide.

Grade 608 Chrome Carbide can be attached by brazing, by mechanical means or by thermosetting resin cements. It is necessary to flash plate chrome carbide parts with nickel for brazing with conventional materials.

The results of recent tests with ethoxyline resins as a bonding agent for attaching chrome carbide to non-porous materials like metals have been very encouraging. Bond strengths of the ethoxyline resin cemented joints at room temperature are much lower

continued next page

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than brazed joints but approximately equal to those of soft soldered joints. In general, resin-cemented joints can be used in place of brazed joints where high strengths are not required and when the application operates at room or slightly elevated temperatures.

Use of ethoxyline resin cemented joints precludes that the surfaces of the carbide and metal be clean. They should be grit-blasted and rinsed clean with a solvent. Although ground or smooth surfaces do not bond well, as-sintered or sand blasted surfaces on carbides produce satisfactory bonds.

Bond shear strengths of from 5000 to 8000 psi at room temperature have been obtained with ethoxyline cements of several manufacturers using various curing methods. At 200F bond strengths decrease to half the above values. Prolonged immersion in water weakens the bond about 15 percent.

Carbide parts that have been attached by ethoxyline resin cements can be removed by heating the joint to 600F at which temperature the cements decompose and the parts can be easily pried loose. The charred cement can be removed by sanding or scraping.

Thermosetting resin cementing of chrome-carbide parts for wear-resistant applications is often a useful technique especially where brazing is impossible or inconvenient to apply.

Typical appliciations

The excellent corrosion and erosion resistance, of Grade 608 Chrome Carbide combined with good abrasion resistance point to successful applications in broad fields in industry, as indicated in Table 2.

There are many other divergent applications such as: shear blades for molten glass, core pins for baking ceramic parts, finishing rod guides that resist salt water atmospheres, textile machinery guides, mold components for die casting processes, punches for movie film and a host of other applications where stainless steel is not sufficiently abrasion-resistant. Mechanical parts for all types of machinery that must resist wear, corrosion, high temperatures or erosion are also 'naturals' for the new carbide.

GALVANIC SERIES

continued from page 35

parts are, therefore, zinc plated, and since zinc is immediately next to magnesium alloys in the galvanic series, the rate of corrosion between them will be extremely slow and probably no-existant under normal conditions.

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Another difficulty that arose due to the change-over to magnesium was in the machining of the castings. In common with aluminum all holes smaller than those to be tapped with a 6-32 thread are drilled (the larger holes are cored in the casting operation), and all threaded holes are tapped. The seats for all cross members and brackets are milled and some few other minor machining operations performed.

Machine speeds, rates of feed, depth of cut, and tool shape must all be different for magnesium than for aluminum. In a small shop this might be a minor matter, but for a large, high production shop, it meant a major retooling program and to some extent, an educational program to teach the machine operators how to handle the new metal.

In grinding and polishing departments, another problem came up. The presence of finely divided magnesium metal in the air is intolerable. A ventilating system that might be adequate for handling aluminum is not adequate when magnesium is being ground and polished. It was necessary, therefore, to improve the ventilating system and the method of disposing of the dusts collected.

While the problems that arise in connection with a conversion from aluminum to magne-

continued next page

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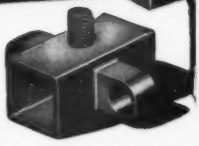

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From a letter from Carl R. Brownell, President, G. L. Brownell, Inc.

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The LITEMETAL BULLETIN

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Close Co-Operation Between The Die Caster And Plater Is Essential To Successfully Give Aluminum Die Castings Fine, Smooth Finishes

Commercial plating of the light metals is relatively new. As in the zinc die casting industry, aluminum die casters have had to virtually re-learn their art in order to produce castings of sufficiently high quality to provide flawless plated surfaces.

Litemetal has proved itself capable of producing plating quality castings, for the Kitchen-Quip Saladmaster (illustrated), in large quantities. Working closely with one of the most successful platers of aluminum, Litemetal has developed the high quality standards and specialized techniques necessary to make plating of this die cast product practical.

Because of its lightness and lower cost, die cast aluminum was chosen for the body, handle and legs of the Saladmaster. Virtual elimination of machining and consequent labor savings effected, plus reduced shipping costs, made this choice most practical. The product's required appearance was attained with chromium plate. Production rates now approach 1,000 sets per day and will increase greatly as soon as plating facilities can be expanded.

Let's Talk It Over . . .

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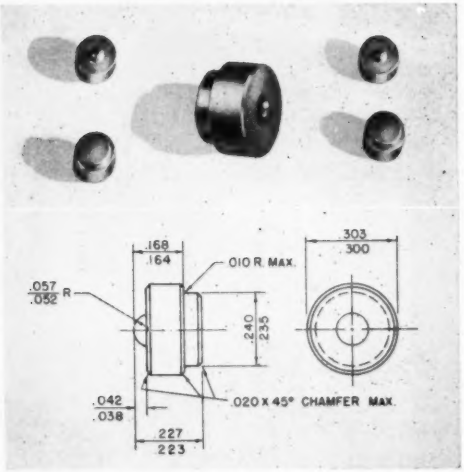

screw machine
cold heading
powder metallurgy ?

You'd be right in saying that all three production methods are possibilities for this firing plug used in the Army's M-32 percussion primer.

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Even under closely competitive conditions, these and other precision advantages are reasons why more and more small structural parts are being designed or bought as brass sinterings (parts fabricated from brass powder).

* Acceptable quality level. If more than 7 defective pieces are found in a 600 sample taken from a 20,000 piece lot, the entire lot is rejected.

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sium die castings have been detailed at some length, none of them is particularly serious if the shop management and the design department knows of them in advance. The need for protective surface coatings, the slower machining speeds and the more elaborate dust collecting and disposing equipment needed, all increase fabricating costs so that the ultimate cost of a part made from a magnesium die casting may well be greater as it is in this case, than the same part made from an aluminum die casting.

While not particularly true in the case of a typewriter base, there are many cases where the lighter weight of the magnesium may have a sufficient advantage, even if only in sales appeal, to more than offset any slight added costs.

Turning now to some of the other conversions made by Royal Typewriter Co., some positive improvements are noted. The several cross members shown in Figure 1, such as the the type bar lever bracket, the key lever bracket and the front link bracket, were changed from cast iron to aluminum die castings. As a result of this change, the machining costs have been sharply reduced and a cleaner part produced. An unexpected dividend of this change came about in the reduced housekeeping load. The machining of cast iron produced a dust which settled over men, machines and buildings. Since the substitution of aluminum for cast iron, this problem has been eliminated with attendant decrease in overhead for cleaning and, in addition, a marked improvement in working conditions.

INVESTMENT CASTING ALLOYS
continued from page 45

and risers which often constitute 50 percent of the gross casting weight. Now instead of selling this at the price of scrap, it may be returned for realloying and remelting into fully certified Master Melting Metal*

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***Master met is the registered trademark for Master Melting Metals produced by Cannon-Muskegon.**

RESISTANCE TO BREAKING

continued from page 57

to prevent slippage without stressing either the casting or the threads to the breaking point. As a result, breakage has become rare unless the technician is far too zealous in his tightening of the clamps and screws.

In those cases where a die cast body must be fastened to a brass support rod, a tubular rod is used and pressed into the casting. A staking operation then fastens the two parts together, forming in essence two integral rivets, diametrically opposed.

The burette holder and variable-flow pinch cock shown in Figures 3 and 4 are examples of the die cast and plated laboratory equipment now being used.

Because of the versatility of the die casting process, it is possible to make many clamps and fixtures that were economically impossible when cast iron was used. Examples of this flexibility are shown in Figure 1, where a relatively simple support rack is being assembled and Figure 2 showing a more complex setup where literally hundreds of Castaloy clamps, fittings and supports are used.

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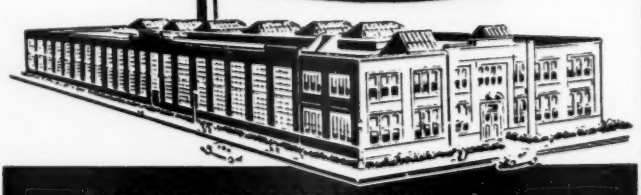
NAVAL ORDNANCE, ETC.
continued from page 46

pound, manganese bismuthide, and unreacted manganese and bismuth.

To get the enriched bismuthide from the mixture the material is ground and the magnetic portions separated from the non-magnetic metals by a magnetic separator. The magnetic portion is then hot pressed at a temperature of 300°C in a double acting floating die in the presence of a strong magnetic field. The latter is used to align the particles along the direction of easy magnetism.

Bismanol magnets made in this manner not only show the high coercive force mentioned above but also have a maximum energy product comparable with Alnico magnets (3×10^6 gaussoersteds) and a Curie temperature of 350°C.

From One Source



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RACINE

ZINC OR ALUMINUM die castings of highest quality produced on modern, fast equipment. Guaranteed satisfaction. Prompt service.

Inquiries Invited

Tell us your needs. Send blueprints or drawings for quotation. No obligation, of course.

RACINE DIE CASTING CO.

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OPPORTUNITIES

HELP WANTED:
We have openings for capable representatives in metropolitan N. Y., north and south N. Y., eastern Penna., Delaware and Maryland.
Applicants must have good following in the die and mold field and be able to demonstrate the Di-Profiler in the shops. Men with 2 or 3 other items can increase their income considerably.
Please address replies to Nord International Corp., P. O. Box 44,Denville, N. J., or phone Rockaway (N. J.) 9-3199.

FOR SALE:
One Lindberg-Fisher Electric Induction Stationary Holding Furnace for Aluminum; 40 KW, 230 volts, 60 cycle, single phase. Complete with control panel and control equipment. Write Box 10252, Precision Metal Molding Magazine.

POWDER METALLURGIST
Familiar with all phases of sintered metal parts manufacture (Including stainless steel).
Preferably also having E. E. and acquainted with powder metal projects related to the electronic and aviation industries.
Please state experience, previous positions held, references and salary requirements.
Replies held strictly confidential. Reply to Box No. 10152, Precision Metal Molding Magazine.

REPUTABLE SALES REPRESENTATIVE with outstanding following wishes to represent a die casting firm of high calibre for the Middle West territory. Reply to Box No. 10352, Precision Metal Molding Magazine.

Sales organization needs Light Metal Die Casting source to represent on national or restricted territory basis. Finest references. Write Box 10452 Precision Metal Molding Magazine.

FOR SALE
Two Light Metal Machinery "Work Horse" die casting machines, in good operating condition. Can be seen on premises, in operation. Write Box 10552, Precision Metal Molding Magazine.

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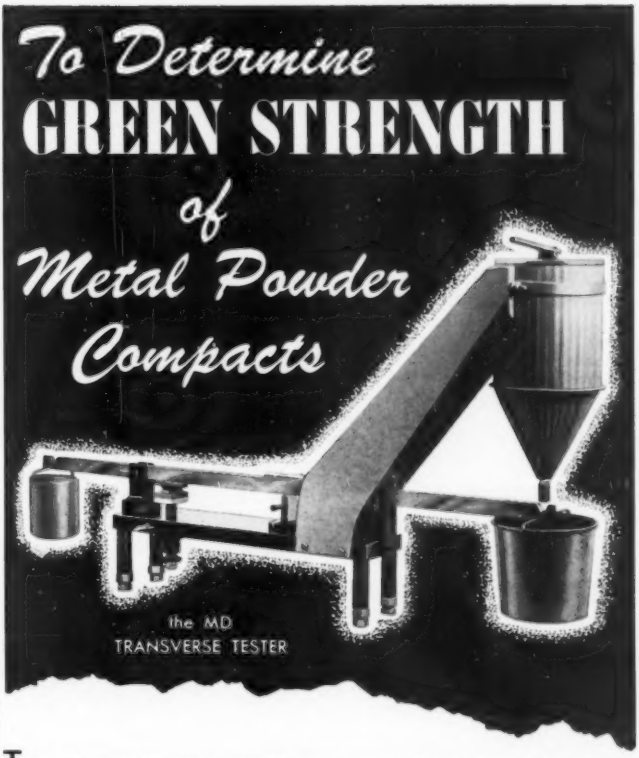

THE MD TRANSVERSE TESTER was especially designed for determining strength of fragile materials. Its applicability in Powder Metallurgy is the determining of strength of metal powder compacts in the *green* (unsintered) condition. This instrument meets the Metal Powder Association Standard 15-51T.

Numerical value determined by this instrument, known as the compact's "*green strength*", is useful in ascertaining if the compact will meet all the requirements of a particular job.

The instrument is used as an inspection device as well as a general laboratory instrument for development work. It is also useful in determining strength of materials other than metal powder compacts, such as ceramics, glass, plastics, etc.

Write for price and complete details.

METALS DISINTEGRATING COMPANY, INC.
Elizabeth 8 • New Jersey
Plants: Elizabeth, N. J., Manchester, N. H., Berkeley, Calif., Emeryville, Calif.
SUBSIDIARY OF AMERICAN-MARIETTA COMPANY

1951 MD Since 1916
METAL POWDERS
METAL PIGMENTS
METAL ABRASIVES
WORLD'S LARGEST MANUFACTURER OF FINELY DIVIDED METALS

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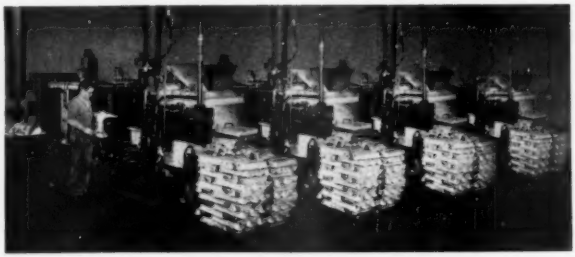

New and improved cold chamber machines at FEDERAL now produce larger aluminum die castings of superior quality. Consult FEDERAL before making your decision!
FEDERAL built dies and high pressure casting equipment with water hydraulic impact injection assure die castings of GREATER DENSITY and BETTER FINISH!

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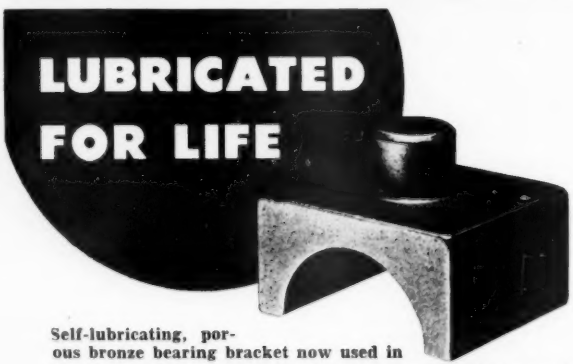

Self-lubricating, porous bronze bearing bracket now used in textile machinery to support long, overhanging shafts are impregnated with a special formulated plastic lubricant to provide non-drip lubrication at all temperatures. Whenever you need clean, ready-to-assemble powdered metal parts with special physical characteristics to meet your specific requirements, contact International Powder Metallurgy Co.

Now available—the Powder Metallurgy Engineers Handbook. Send for a copy on your company's letterhead.

IPM
International Powder Metallurgy Co.
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OPPORTUNITIES
continued

FOR SALE

Harvill zinc die casting machine with all controls, late model, used little, good condition, reasonable price, will shoot 7 lbs. Chicago Scale & Slicer Co., 2944 W. Lake St., Chicago, Ill.

SLIDING ASSEMBLY
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4. Tap hole for machine screw to hold spring block in place.

One other advantage was gained by converting to a die casting. All lettering and numbers that are desired on the frame can be incorporated in the die and raised letters cast on the switch. With a sand casting, this was not possible. If letteriing was included on the final switch, it had to be stamped on as a separate operation. Scrap loss is almost nil at present as compared with a former high scrap due to machining.

The spring block (2b) was, as noted, formerly machined from bar stock. A material waste of about 50 percent accompanied this operation and the time required to machine to tolerances that would permit interchangeablity was excessive. As die cast, the block is used as received from the foundry with absolutely no machining operations being necessary.

Some reduction in manufacturing cost has accompanied the change from the older manufacturing methods to die casting. While not great, in this case about 25 percent, a very real saving is made but of even more importance is the release of men and machines for other work. As noted, inspection time has been materially reduced so that the over-all savings resulting from a change to die casting is probably far greater than the 25 percent figure would indicate.

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HOEGANAES

Sponge Iron Powder

Hoeganaes sponge iron powder will be available from the plant in southern New Jersey, which is now being erected.

These new greatly expanded facilities will make this fine product more available for fabricators.

For expert design consultation, call in your powder metal fabricator, who will be in a position to recommend your most profitable use of HOEGANAES Sponge Iron Powder.

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Sellers of Hoeganaes sponge iron powder.

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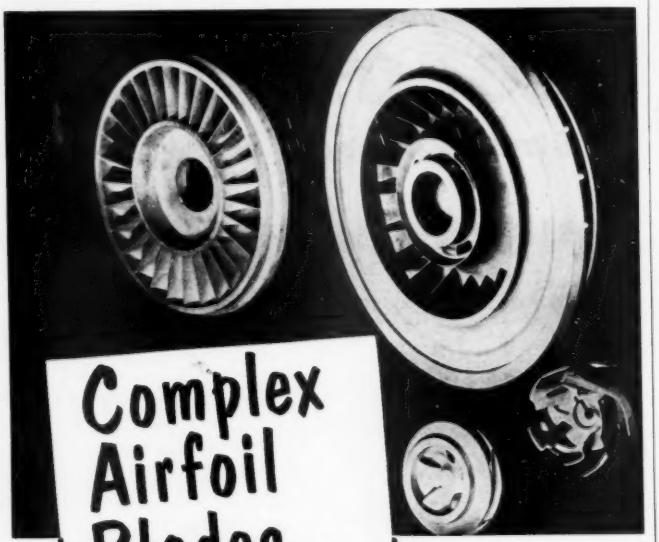

PLASTER MOLD CAST BY

UNIVERSAL TO INCREASE OPERATING EFFICIENCIES

Hydraulic transmission wheels and fuel pump impellers cast to close tolerances with smooth surfaces in plaster molds. Sizes vary from 2" to 16" diameter. Accuracy in blade spacing and uniform blade thickness is necessary for good performance. Large size wheel operates at 3000 r.p.m. and small shrouded impeller at 36,000 r.p.m. Smooth, uniform blade surfaces produced in plaster molds reduces to a minimum resistance to flow or fluids resulting in greatly increased operating efficiencies. Wheels illustrated are cast in aluminum with trailing edges of blades cast to knife edge while other sections of blades in small impellers do not exceed 3/32". Two larger wheels are used in hydraulic transmissions and two smaller impellers on airplane fuel pumps. Accuracy in casting blade form combined with close tolerance on variable blade sections is a necessary requirement. All types of complex blade designs can be produced in plaster molds.

UNIVERSAL CASTINGS CORP.

5821 W. 66th Street • Chicago 38, Illinois

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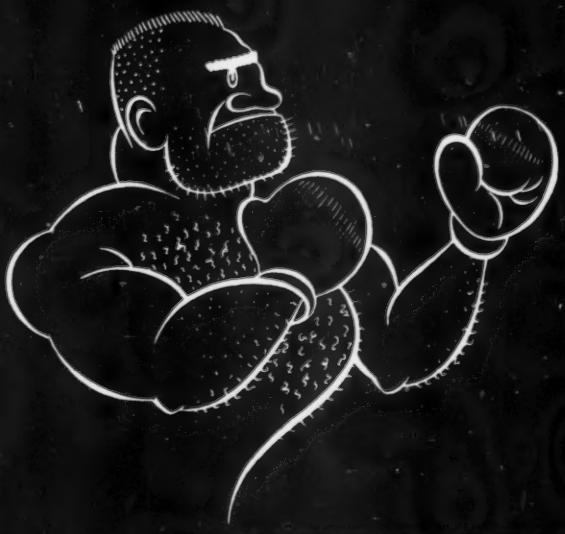
We've whipped some tough production problems!



We have assisted many times in re-designing the components of difficult assemblies so as to permit the substitution of die castings.

This has resulted not only in whipping some tough production problems but has effected considerable savings in over all costs.

Consequently—a better, less expensive and more desirable finished product.

We're ready at all times to extend a like service to you!

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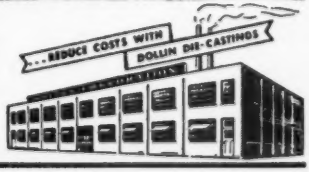

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